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Telephony.

AN ILLUSTRATED MONTHLY TELEPHONE JOURNAL

VOLUME I.
NUMBER 3.

CHICAGO, MARCH, 1901.

10 CENTS A COPY.
50 CENTS A YEAR.

INDEPENDENT
TELEPHONE SUPPLY COMPANY
TELEPHONE CONSTRUCTION SPECIALTIES AND SUPPLIES
19 SOUTH CANAL STREET, CHICAGO.

KEELYN
TELEPHONE MFG. CO.
TELEPHONES, SWITCHBOARDS
355 DEARBORN STREET, CHICAGO, ILL.

ACME
ELECTRIC CO.
MAGNETO BELLS.
Efficiency, Material and Workmanship Guaranteed.
WRITE FOR PRICES.
ACME ELECTRIC CO.,
231 S. CANAL STREET, CHICAGO.

TELEPHONE SUPPLIES
PROMPT SHIPMENTS
LARGEST AND MOST COMPLETE STOCK
ELECTRIC APPLIANCE COMPANY
92 & 94 WEST VAN BUREN STREET
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ELECTRICAL SUPPLIES

WATER MOTORS
For driving Telephone Generators in Telephone Exchanges.
Over one hundred of these motors in use by the Central Union Telephone Company. Address
Chicago Water Motor & Fan Co.,
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ELECTRIC CO., CHICAGO
DEALERS IN
TELEPHONE AND ELECTRICAL SUPPLIES
OF EVERY DESCRIPTION
SEND FOR CATALOGUE AND PRICE LIST.

CHICAGO TELEPHONES SATISFY.
CHICAGO TELEPHONE SUPPLY COMPANY, CHICAGO, ILL., U. S. A.

AMERICAN
STORAGE CELLS ARE THE BEST
SEND FOR DESCRIPTIVE CIRCULAR
AMERICAN BATTERY CO.
172 S. CLINTON ST., CHICAGO, ILL.
ESTABLISHED 1889

MATHIAS KLEIN & SON,
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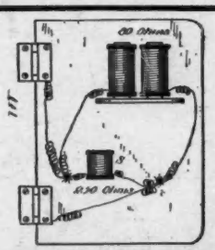
CHICAGO.
MANUFACTURERS OF
LINEMEN'S CONSTRUCTION TOOLS.
WRITE TO-DAY FOR OUR
"RED BOOK"
It is of pertinent interest to every telephone man and will be sent free upon request.

The use of these shunts makes a series grounded line as good as a bridged line.

Inductive and non-inductive resistance made at short notice.



50 Cents Each.
Discounts in quantities.

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CHICAGO, ILLINOIS.
WRITE FOR OUR REFERENCES.

PONTIAC ENGRAVING & PUB. C

SEND FOR SPECIMEN CIRCULARS.

Alphabetical Index to Advertisers, Page XIX.

INDEPENDENT LOCAL AND TELEPHONE LONG DISTANCE SYSTEM

EUREKA ELECTRIC CO., Manufacturers of the

LARGEST LINE OF TELEPHONE APPARATUS, EQUIPMENT AND ACCESSORIES IN THE WORLD.

While in Chicago visit the Eureka Electric Building, the Most Modern Telephone Factory in the country,

143-145 S. CLINTON ST., CHICAGO, ILL., U. S. A.

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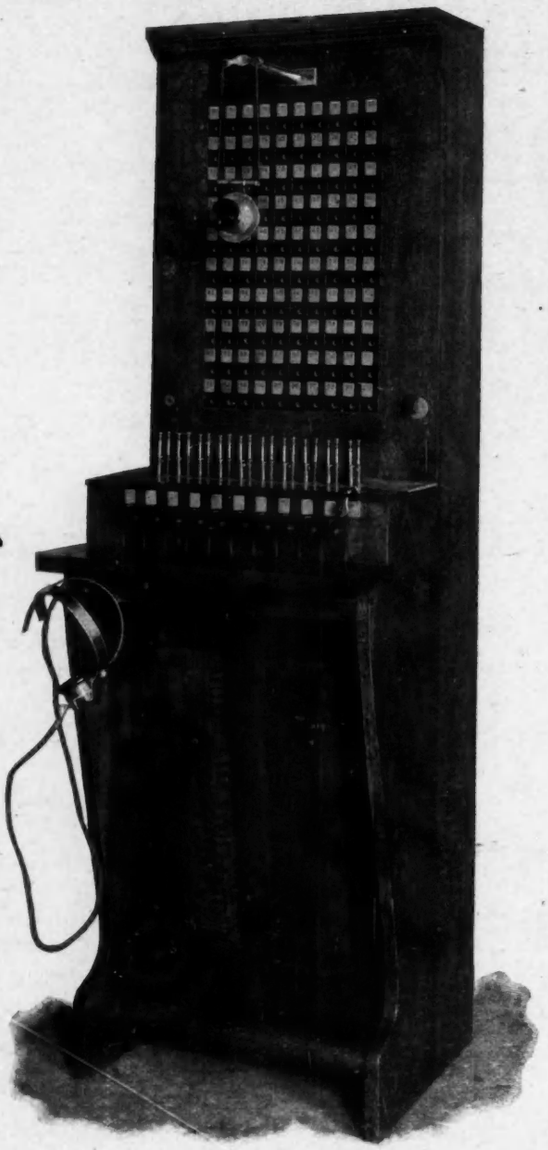
Special No. 91.

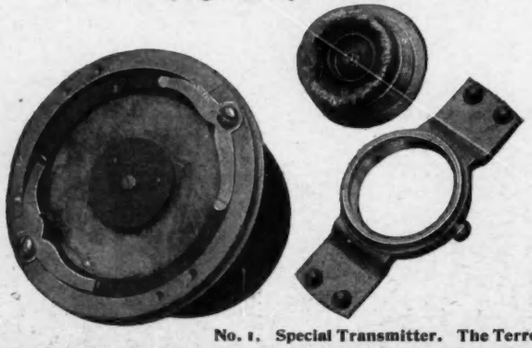


Eureka Express Switchboard. Built with either Flash Light or Drop Signals. Superior to all.

No. 49. Auto. Signal Telephone. Just the Telephone for Magneto System for Subscribers Who Won't Ring Off.

No. 97. Compact Magneto Telephone.

No. 50. Central Energy Common Battery Telephone.



No. 1. Special Transmitter. The Terror of all Competitors.

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See Our Exhibit Pan-American Exposition, Buffalo.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

Chicago Telephones Satisfy.

This is it.
Everyone knows

Chicago Bridging Telephone

MODEL 17.

WE MADE IT and IT MADE US.

Your toll line service may be good with other instruments, but it will be perfect if Chicago Telephones are used exclusively. Up-to-date Toll-Line Companies everywhere have proved this assertion.

CHICAGO TELEPHONE SUPPLY CO.

Office and Factory:

Canal and Washington, - CHICAGO.

Chicago Telephones Satisfy.

They come in all shapes and sizes to suit the individual taste.

If you don't see the cabinet you prefer, **ASK FOR IT.** If it bears the

CHICAGO

nameplate you may know it is good.

Our customers are testifying right along. Would you like to see a few recent letters? Write us. Also inquire for our

SAMPLE ORDER PROPOSITION.

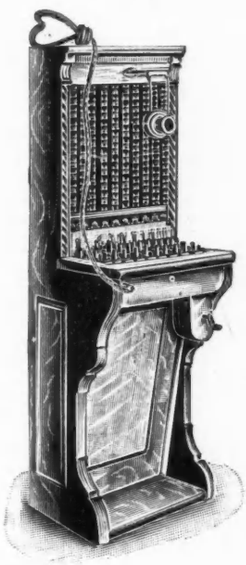
IF YOU ARE NOT ALREADY A CUSTOMER, IT WILL INTEREST YOU.

CHICAGO TELEPHONE SUPPLY CO.

Office and Factory:

Canal and Washington, - CHICAGO.

Chicago Telephones Satisfy,



ALSO

CHICAGO EXPRESS SWITCHBOARDS

Eleven were sold to one company for its various exchanges during the year 1900. Superior salesmanship might enable a factory to sell a large number of switchboards to different companies, but when so large a number are sold, at different times, to one company, it proves conclusively that the board has decided claims for

SUPERIORITY.

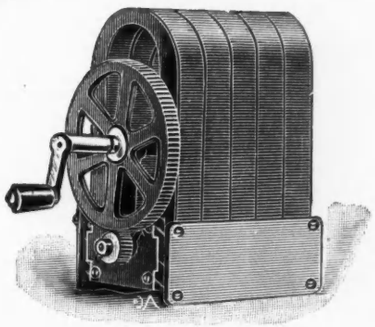
A postal card will bring full description with illustrations of this superb instrument.

CHICAGO TELEPHONE SUPPLY CO.

Office and Factory:

Canal and Washington, - CHICAGO.

Chicago Telephones Satisfy.



The Generator Guarantees Satisfaction.

It has a laminated armature and laminated magnets, which combination enables it to ring more bells connected in multiple than any generator on the market. When it comes to the question of producing the strongest bridging generator

WE KNOW HOW.

That is why this factory has been enlarged three times within a year.

That is why the pay roll of this factory has never been even temporarily reduced, since the expiration of the basic Bell Patents.

CHICAGO TELEPHONE SUPPLY CO.

Office and Factory:

Canal and Washington, - CHICAGO.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

Kellogg Switchboard and Supply Co.,

MANUFACTURERS OF

Telephones, Switchboards and Complete Equipments for Small or Large Exchanges.

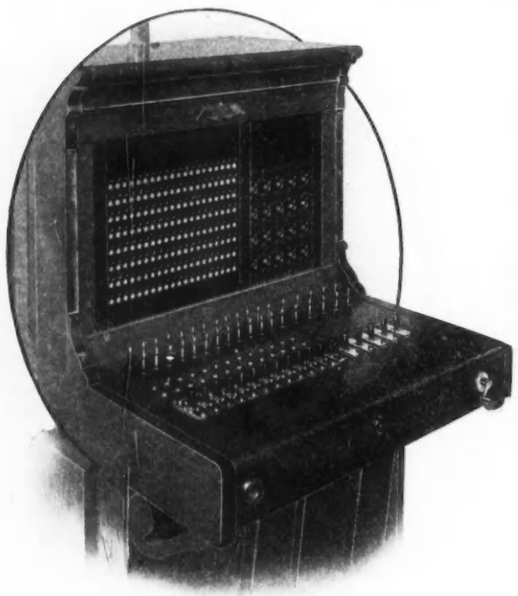
GENERAL OFFICES AND FACTORY.

Kellogg telephone apparatus is made to work. It is designed by engineers who have had large experience in all branches of telephone practice, and its present use in the largest exchanges in the United States, eight of which have an aggregate present capacity of over 40,000 lines, is proof that it does work.

DRY CELL TYPE WALL TELEPHONE.

We are now putting on the market a line of small switchboards which embody all the essential features of the larger boards and are adapted for use in exchanges having capacities from 50 to 400 lines.

ANY SYSTEM, CENTRAL ENERGY, LOCAL BATTERY, OR MAGNETO CAN BE USED.



COMBINATION CENTRAL ENERGY AND MAGNETO SWITCHBOARD.
Capacity: 160 Central Energy Lines, 20 Magneto Lines.

Our combination central energy and magneto board shown here has lamp line signals, double lamp supervisory system, mechanically self-restoring drops, tubular clearing-out drops and cam combination ringing and listening keys.

Send for Bulletin No. 2 on Small Switchboards.

PORTABLE DESK TELEPHONE.

GENERAL OFFICES AND FACTORY: 239 SO. GREEN ST., CHICAGO.

NEW YORK OFFICE: 346 BROADWAY.

Congratulations on

The Berliner Transmitter Decision.

THINGS TO BE PROUD OF:

We have confidently believed that the Berliner decision would go against the Bell people, and as an evidence of our convictions we invested a large amount of capital in our manufacturing plant and in an extensive series of patents of OUR OWN. Our factory is illustrated on opposite page. COME AND SEE THE PATENTS.

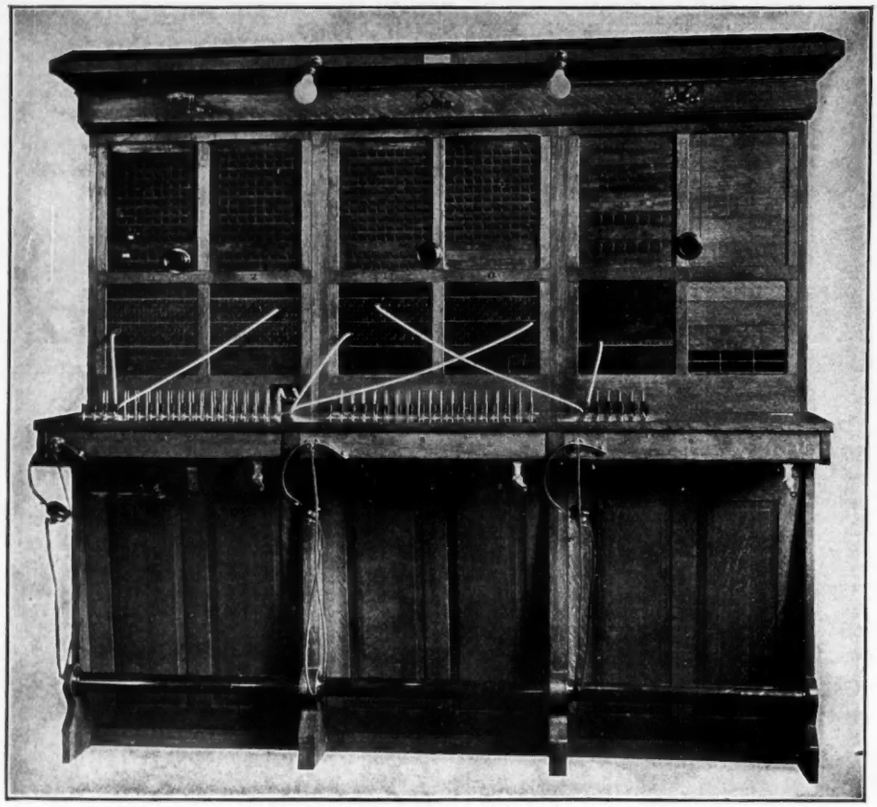
Our business more than trebled itself in two years in spite of the handicap of the then impending Berliner decision, and during that time we have built switchboards ranging in size from the largest in the world (not excepting any, whether Independent or Bell) down to those for the smallest villages. ALL OF THESE, WITHOUT EXCEPTION, ARE IN SUCCESSFUL OPERATION.

There are good reasons for our success, and they may all be summed up in the words, GOOD DESIGN, CONSCIENTIOUS WORKMANSHIP, CONTINUED EFFICIENCY, backed by ABSOLUTE PATENT PROTECTION, together with honest dealings.

Kellogg Switchboard and Supply Co.,

GENERAL OFFICES AND FACTORY: 239 SO. GREEN ST., CHICAGO.

NEW YORK OFFICE: 346 BROADWAY.

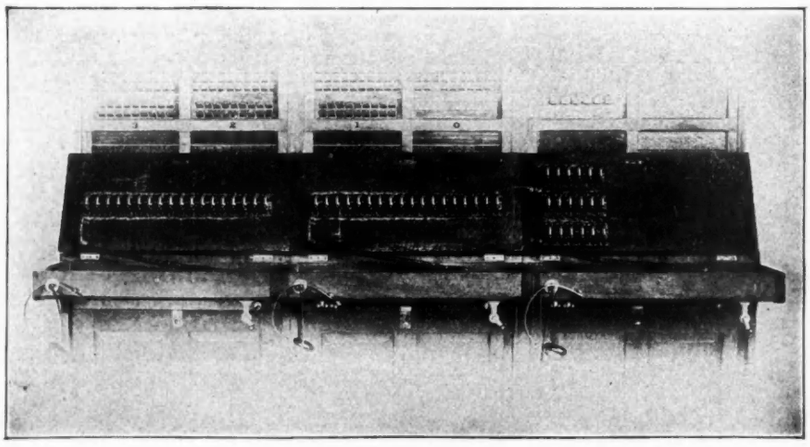


Saves
50%
—IN—
Operators'
Salaries.

IT IS A
Dividend Payer

Automatic In Operation.

NORTH SUPERVISORY SYSTEM



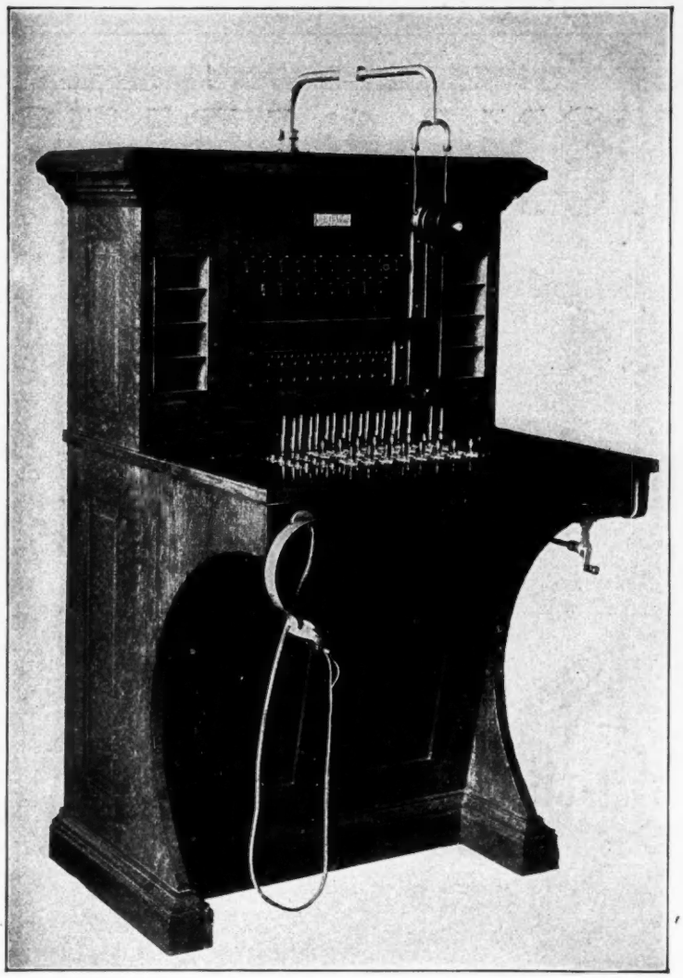
Full
Supervision
of all
Connections.

FOR PARTICULARS, WRITE TO

The North Electric Co.

69-79 FRANKFORT STREET, - - CLEVELAND, OHIO.

Please tell the Advertiser you saw his Announcement in TELEPHONY.



TOLL BOARDS

All Kinds.

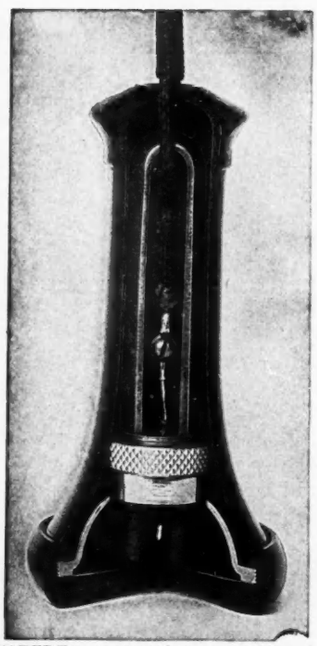
Long Distance Apparatus, Central Office Equipment, Receivers, Transmitters, Generators, Protectors, Repeating Coils, Central Battery Systems.

FULLY GUARANTEED.

OUR new receiver mounted in a blown rubber shell of the highest grade, can be adjusted and locked, and made to fit any conditions demanded.

MAGNETO CALL TELEPHONES

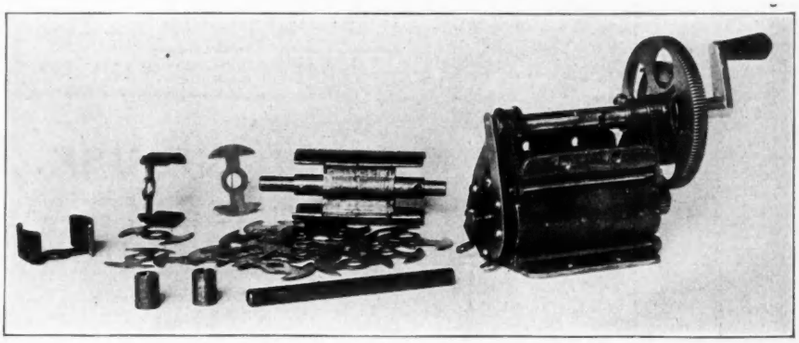
WE SET THE PACE.



THERE are no terminals or metal parts exposed, and no strain on the cord terminals.

We Kill The Telephone Imp.

WRITE FOR PARTICULARS TO ....



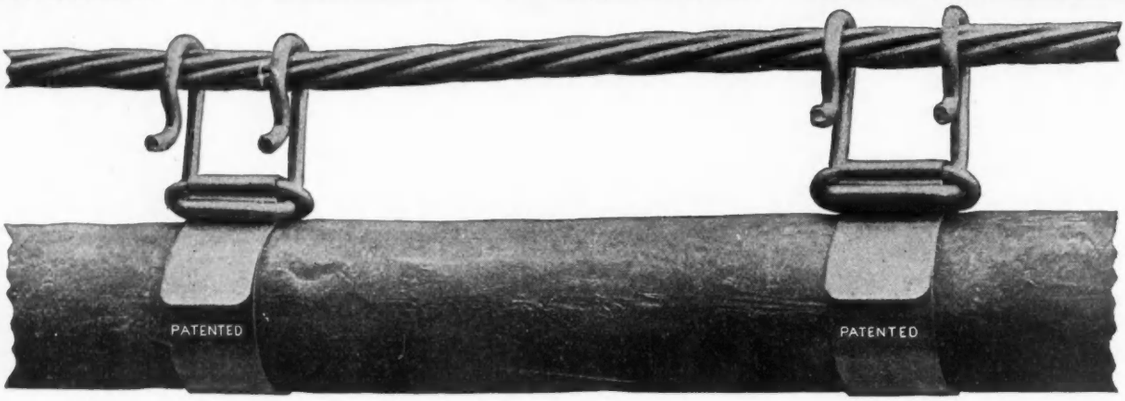
LAMINATED Armature in all generators. Positive mechanical shunt. Wearing parts interchangeable. Powerful and light running. Highest grade made.

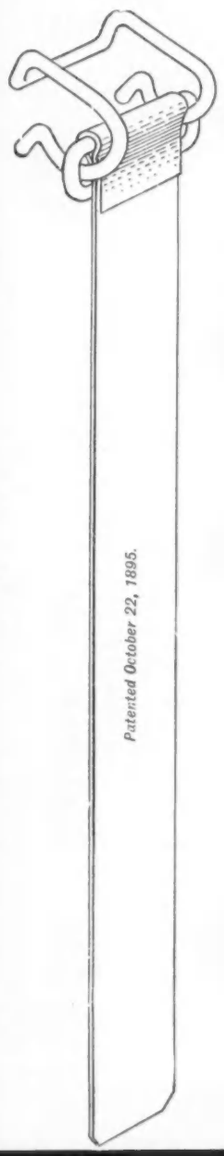
The North Electric Co.

69-79 FRANKFORT STREET, - - CLEVELAND, OHIO.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

FOR..... HANGING TELEPHONE CABLES





Why don't YOU use

THE "Boston Cable Clip"

TOO?

The largest Telephone Systems in the country are using them EXCLUSIVELY,

BECAUSE

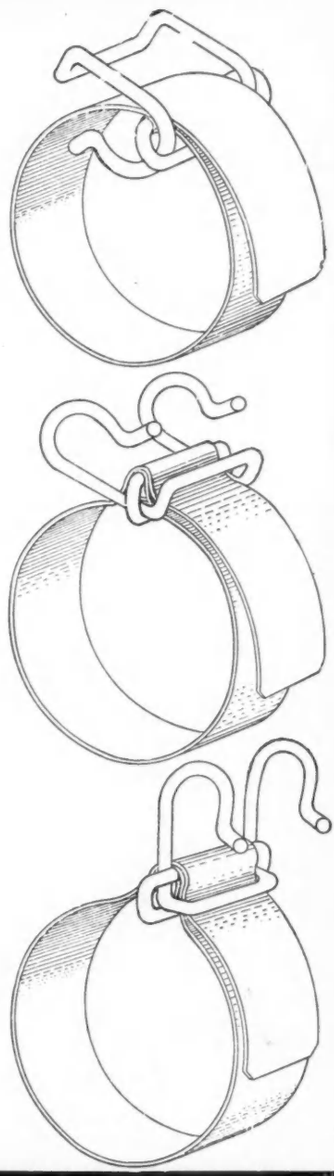
They are the most ECONOMICAL.
They are the most DURABLE.
They are the most EFFICIENT.

BECAUSE

They WILL NOT SLIP.
They are **ADJUSTABLE TO ANY SIZE CABLE.**

MILLIONS IN USE.

LET US TELL YOU ABOUT THEM.



CHASE-SHAWMUT CO.,

(SOLE MANUFACTURERS)

Boston, Mass.

MACOMBER & WHYTE, Western Agents, Chicago, Ill.

OUR LEADER.

LATEST TYPE AND
MOST IMPROVED
TELEPHONE
ON THE MARKET.
BEST QUALITY
THROUGHOUT.

Receiver and Generator
on a level with arm.
Transmitter
on a level with mouth.
All Working Parts Easily
Accessible.

We Manufacture Full Line Telephones and Switchboards for Exchange and Long Distance Use.

CONSTRUCTION MATERIAL AND SUPPLIES USED WITH TELEPHONES.

CENTRAL TELEPHONE & ELECTRIC CO.,

No. 909 Market Street, ST. LOUIS, MO.

WE MANUFACTURE

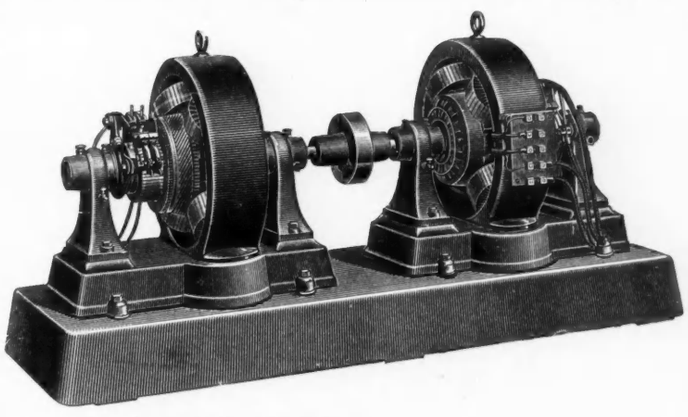
MOTOR-GENERATORS

—FOR—

Charging Storage Batteries.
Used Directly on the Talking
Circuit.

—FOR—

Ringing Purposes and
Selective Party Line Work.



WRITE FOR PARTICULARS.

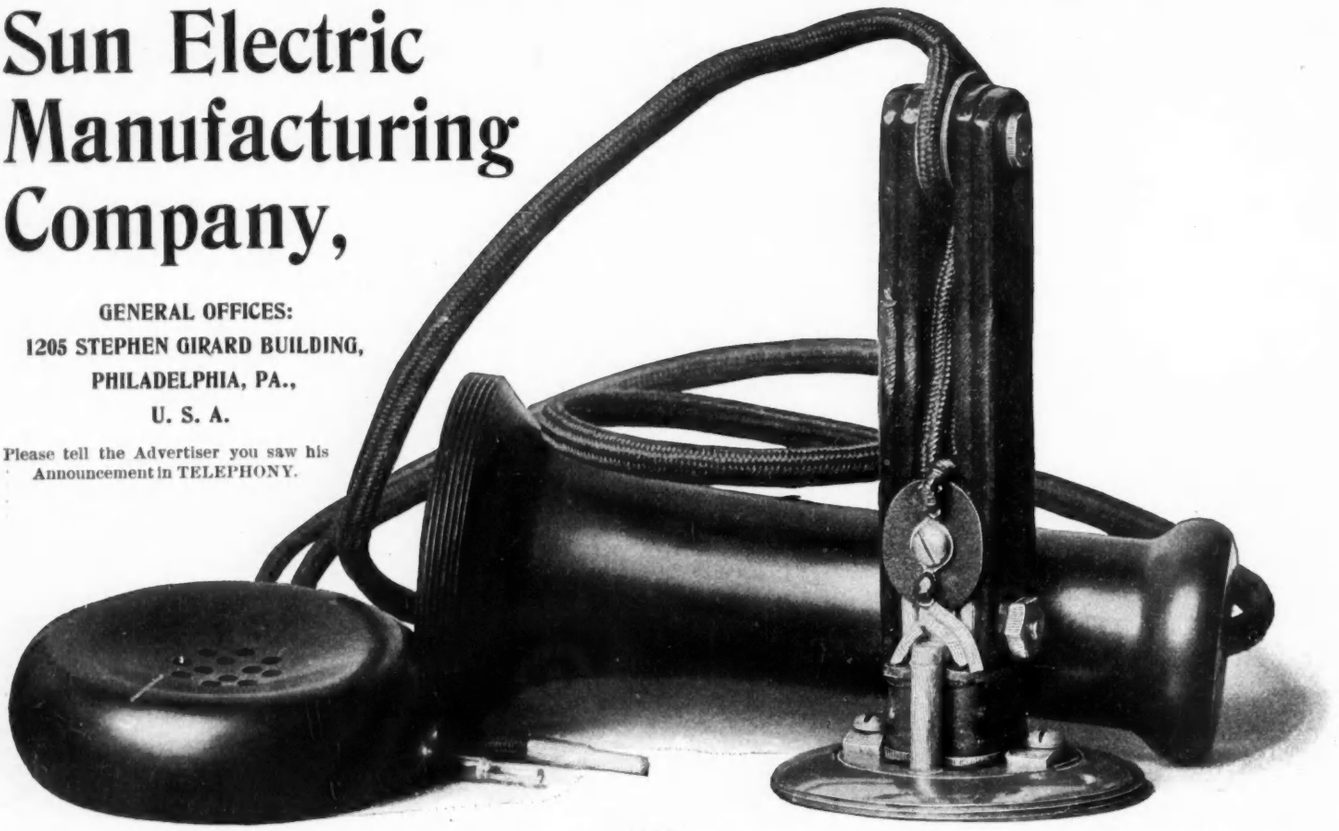
The Holtzer-Cabot Electric Co.

397 Dearborn St., Chicago. Ill. Boston (Brookline), Mass.

Sun Electric Manufacturing Company,

GENERAL OFFICES:
1205 STEPHEN GIRARD BUILDING,
PHILADELPHIA, PA.,
U. S. A.

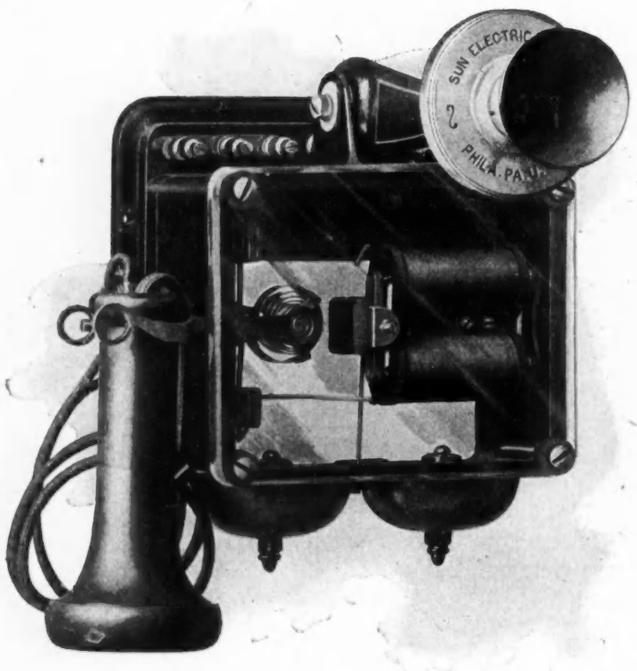
Please tell the Advertiser you saw his Announcement in TELEPHONY.



CUT NO. 2.

RECEIVER. Cuts Nos. 1 and 2. Our receiver is a new departure, like the transmitter. Examine it carefully. It has a genuine hard-rubber shell, of very desirable design, with a cap that is novel in that it contains a series of small perforations instead of the single large opening heretofore used by others. The magnet structure is made as a unit, assembled and adjusted without regard to the shell. The magnet steel is very efficient, specially made for us under a formula guaranteed to perfectly preserve its magnetism at full strength. The cord is secured to the magnet structure, and there are no external binding posts. The entire magnet structure is carried on a metal disc adjustable in a metal ring which carries the diaphragm, and the construction is mechanically and electrically perfect.

As for the talking qualities of these instruments, they are superior to others.



CUT NO 3.

CUT NO. 4.

TRIPLET SETS. Cuts Nos. 3 and 4 show Triplet Sets. The operative parts of the telephone proper are contained in what we call our Triplet box. We originated this box and have had it in use several years with satisfaction to ourselves and customers. It consists of a rectangular casting with open front, to which we fit either a plate-glass or cast-iron cover. The glass front box (Cut No. 3) enables a constant inspection to be had of all parts of instrument, which are nickel-plated and polished. In the iron front they are nickel-whitened, but are otherwise the same. Mounted in Triplet Sets are our Standard Switch Hook, Ringers, and Induction Coil. Mounted on the top of the box is a saddle having a cone-bearing hinge in which turns the transmitter arm This arm is hollow and the transmitter cords are therefore concealed. The pivot screws and fittings of the arm hinge are finely nickeled, as are all the fittings of our instruments.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

Sun Electric Manufacturing Company

The cuts on this page show the Sun standard telephone instruments—one type of wall set which we call "Type A," glass front, and one type of portable desk set which we call "Type D," with rubber grip. This wall set has our well known triplet box, with heavy plate glass front, mounted upon a handsome backboard of entirely original design. All metal parts inside the triplet box are heavily nickel-plated and polished. The workmanship on all parts is of the finest, and we think we have a right to say that these are the handsomest telephones that have ever been produced, bar none.

One of the cuts shows the battery box removed. Observe that the generator and the battery tray are carried directly on the backboard. This makes them accessible, as well as rendering the attachment solid and permanent.

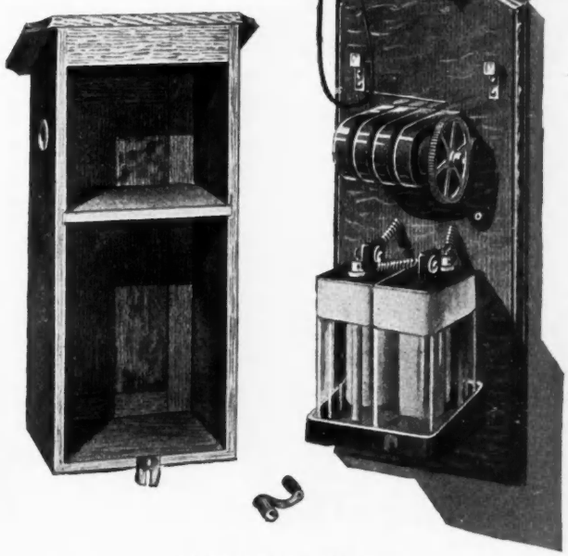
In our desk set we put the switch hook where it belongs, at the top of the vertical column, and we put a crystal in the box so you can see into it. We make fine apparatus and we want to show every part of it.

Note in both of these instruments that all transmitter wiring is concealed. The conductors are two cords led through a hollow arm and a boss respectively. When you screw our transmitter on its nipple, you automatically make the connections without fooling with any wires or cords.

If you need any telephones, give us a trial order. Our instruments sing their own praises, and we want you to join in the chorus.

Wall Set, Type A, Closed.

Sun Portable Desk Set, Type D.



Wall Set, Type A, Open.

We design and manufacture many types of telephones beside the above and all sorts of telephonic apparatus, and it is all absolutely high-grade. Whether you want switchboards or instruments, and whether you want them for some special purpose or not, write to us and give us a chance to figure with you. It is a hundred to one that we can supply just what you want, and a very important fact to remember is, that

OUR PRICES ARE RIGHT.

Sun Electric Manufacturing Company,

GENERAL OFFICES: 1205 STEPHEN GIRARD BUILDING. PHILADELPHIA, PA., U. S. A.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

INDEPENDENT TELEPHONE SUPPLY COMPANY

We have on hand for immediate delivery
10 Bridging Telephones, $9.50 ea.
50 Series Telephones, 7 50 "
10 Desk Set Telephones, 5.50 "
Above are practically new; in first class condition and of well known make.
Subject to Previous Sale.

TELEPHONE CONSTRUCTION SPECIALTIES AND SUPPLIES

19 SOUTH CANAL STREET, CHICAGO

COMPLETE STOCK *PROMPT SHIPMENTS*

WE HAVE A LARGE STOCK OF **WIRE** GENUINE DBLE. GALVANIZED

"EXTRA B. B.," "B. B." AND "MONARCH."

Hard Drawn Copper Wire. *Galvanized Steel Strand.*

"Boston" Cable Hangers, "Crosby" Clips.

Complete Stock of Telephone Construction Material.

Net Price List Upon Application.

Century Telephone Construction Company,

CLEVELAND, OHIO.

MANUFACTURERS OF

Highest Standard Up-to-Date Telephone Apparatus and Accessories,

DESK TELEPHONES
(Neat and Attractive in Design)

WALL TELEPHONES
Series and Bridging,
(HONESTLY AND SUBSTANTIALLY BUILT.)

Intercommunicating and Interior Systems.

Switchboards, Cross-connecting Boards, Terminal Heads,
(BEST IN THE MARKET)

Transmitters,
"CAN'T PACK,"

BIPOLAR RECEIVERS, Etc., Etc., Etc.

We Install Telephone Exchanges Complete.

CORRESPONDENCE SOLICITED. WRITE US FOR CATALOGUE AND PRICE LIST.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

American Telephone Practice

By KEMPSTER B. MILLER, M. E.

$3.00 518 large pages, profusely illustrated, with 379 diagrams and cuts of apparatus. **$3.00**

The London (England) Electrical Engineer says: "This is a book the like of which could not have been produced in this country."

No live telephone man can afford to be without it, as it is a perfect encyclopedia of useful information concerning telephony.

It gives complete specifications, enabling you to intelligently order apparatus or supplies from manufacturers or to properly supervise the installation of an exchange, large or small.

It describes in simple language the theory and practice of modern telephony, including the circuits, mechanical construction and operation of telephones and switchboards.

A complete description is given of storage batteries, their care and maintenance; of aerial and underground line construction, and, in fact, all the important matters which telephone men need to know.

The Telephone Book of the Century.

FOR SALE BY TELEPHONY,

Manhattan Building, Chicago, Ill., U. S. A.

Sal-Ammoniac is a Relic of the Past.

A Dozen Reasons Why

A. B. C.

BEATS THEM ALL.

1. It is the most economical.
2. Has longest life.
3. Assures greatest quantity output of current.
4. Batteries require less attention.
5. Is cleaner.
6. Slower to polarize.
7. Quicker to recuperate.
8. Deposits no crystals.
9. Produces no creeping salts.
10. Carbons last indefinitely.
11. Zincs last longest.
12. Battery terminals do not corrode.

It is not an experiment. We guarantee it to be the best battery excitant ever made. Your money back if you are dissatisfied. Every dealer handles it. Never sold in bulk. SIMPLE, CLEAN, CHEAP. Try it.

AMERICAN COMPOUND CO.

347 SOUTH CANAL STREET,

CHICAGO, ILL.

NOTE OUR NEW ADDRESS.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

NEW EXCELSIOR DRY BATTERY.

Has a higher E. M. F. than the cell claiming the highest, and has a larger current than the cell claiming the largest.

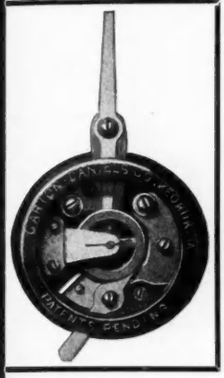
EVERY CELL GUARANTEED RELIABLE.

Sent on approval for 60 or 90 days to any responsible concern to be tested in comparison with any other cell; or money refunded if not found in every way efficient.

WE MAKE ALL SHAPES AND SIZES.

NEW EXCELSIOR DRY BATTERY MFY.
108 Greenwich Street, NEW YORK.

The G.-D. Extension Circuit Ringer.



This device is to be placed on the front of the magneto and is operated by the bell clapper striking the pendulum.
It has no coils in the telephone circuit.
It is purely automatic.
It does not require resetting.
It rings only as long as the telephone.
It prevents batteries running down.
It does not interfere with the talking properties of the telephone in any way.
It will not get out of order.
We warrant it for one year.

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Pamphlet No. T-30 on request.

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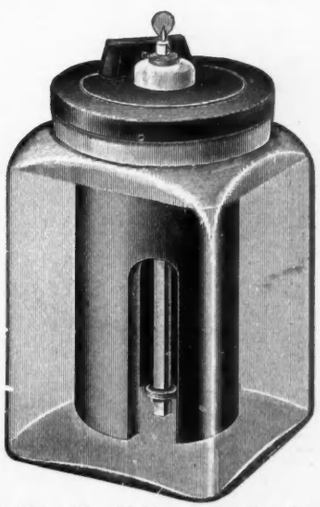

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THE STRONGEST BRIDGING TELEPHONE MADE.

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GOOD
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WIDE CUT GEAR.
HEAVY CAST BEARINGS.
SILK WOUND ARMATURE.
PLATINUM CONTACT HOOK SWITCH-PERFECT CONTACTS
ABSOLUTELY IMPOSSIBLE FOR DUST OR DIRT TO ACCUMULATE.
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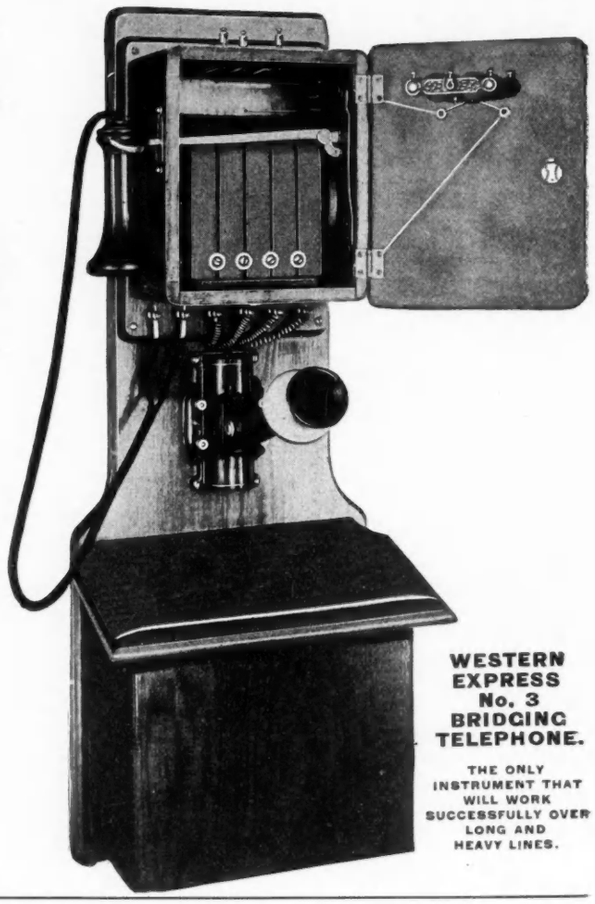
RINGERS 1200 OR 1600 OHMS RESISTANCE.
TWO CELLS (WET OR DRY) BATTERIES.
THE MAGNETO BOXES CAN BE REMOVED FROM BACKBOARDS WITHOUT CUTTING WIRES.
THIS IS NOT TRUE WITH MANY OTHER MAKES.
ALL CONNECTIONS ARE SOLDERED.
ABSOLUTELY GUARANTEED.



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WRITE FOR PRICES. ORDERS FILLED PROMPTLY.

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COMPLETE STOCK.

Everything guaranteed first quality. Prompt shipments.

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Successor to VARNEY & McOUAT,

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We are Headquarters for Telephones and Supplies.
We Furnish Everything Electrical. Prompt Shipments.

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TELEPHONE & CONST. SUPPLY CO., CHICAGO, ILL.

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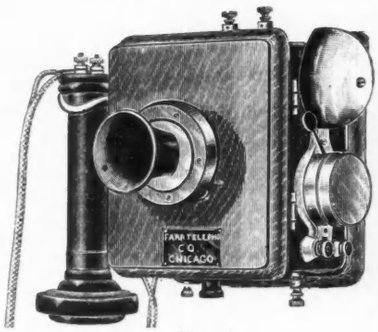

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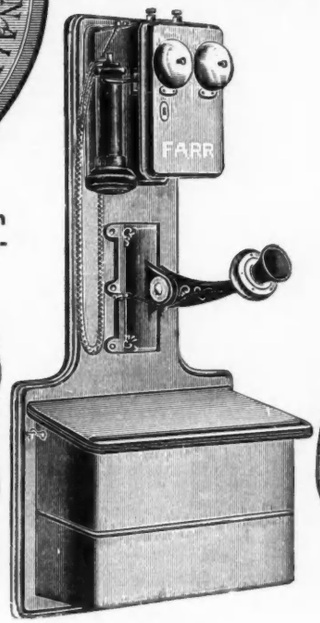

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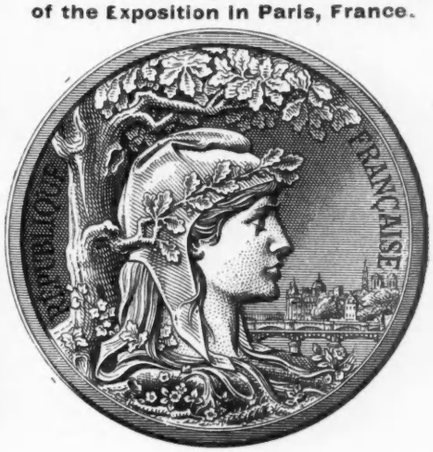
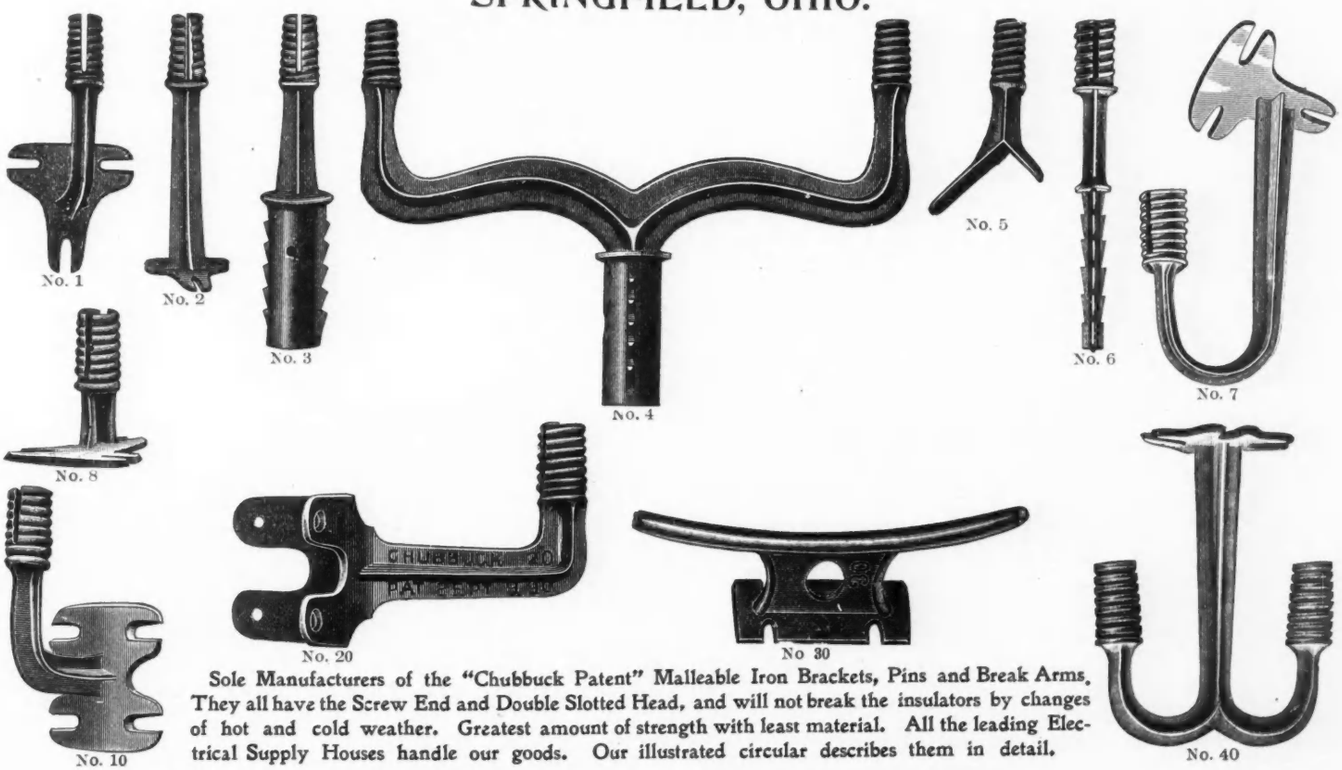
No. 2.

Our Paris Exhibit was sold outright at a good profit at the close of the Exposition in Paris, France.



Electrical Construction Supply Company,

SPRINGFIELD, OHIO.



Sole Manufacturers of the "Chubbuck Patent" Malleable Iron Brackets, Pins and Break Arms. They all have the Screw End and Double Slotted Head, and will not break the insulators by changes of hot and cold weather. Greatest amount of strength with least material. All the leading Electrical Supply Houses handle our goods. Our illustrated circular describes them in detail.

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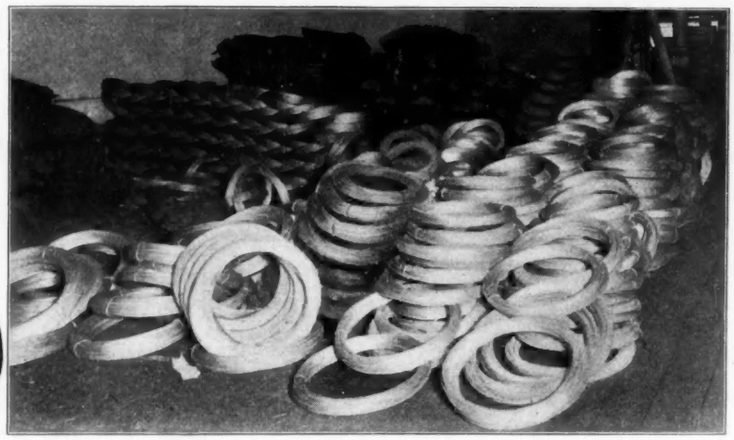
TRANSPOSITION INSULATOR.

No. 9. PONY INSULATOR.

GALVANIZED STEEL STRAND.

FOR GUYS.

ROEBLING'S B. B. GALVANIZED TELEPHONE WIRE.



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POST HOLE SHOVELS—REINFORCED HANDLES.

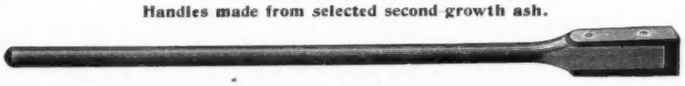
POST HOLE SPOONS.

PIKE POLES.

Made from selected second growth ash, straight grain. Pikes from crucible steel.

WOOD HANDLE TAMPING BARS.

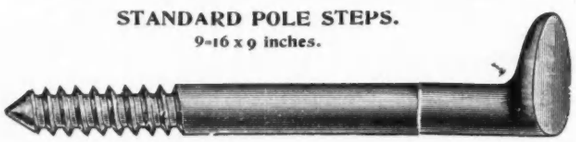
Handles made from selected second growth ash.



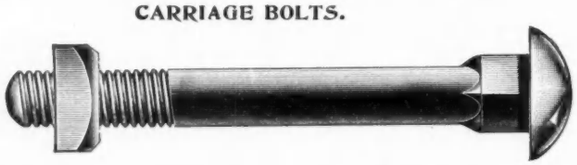
CROSS ARM BRACES.

STANDARD POLE STEPS.

9-16 x 9 inches.



CARRIAGE BOLTS.



STANDARD OAK BRACKETS. 2x12 in.

STANDARD OAK PINS. 1¼x8 in.

LAG SCREWS.

ILLINOIS ELECTRIC COMPANY,

Chicago, Ill., U. S. A.

TELEPHONE APPARATUS and SUPPLIES.

COMPLETE STOCK. LOW PRICES.
PROMPT SHIPMENTS.

SEND TO-DAY FOR OUR TELEPHONE PRICE LIST, NO. 14.

Please tell the Advertiser you saw his Announcement in TELEPHONY.

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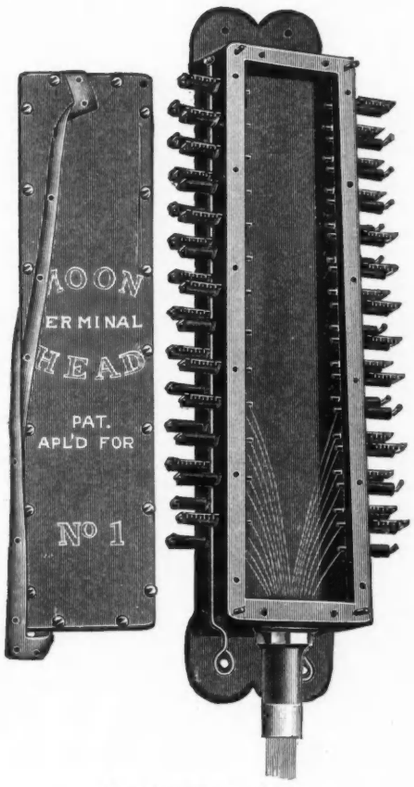


Fuse Terminal. Fig. 1.

Is Your Life Insured?

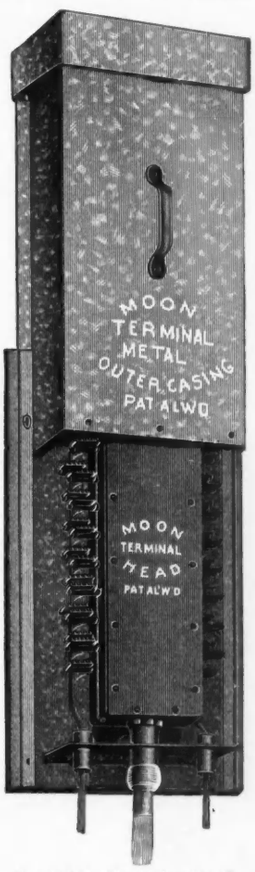
Is The Life of Your Cables Insured With a

MOON FUSE TERMINAL HEAD?

Nothing is more important in an exchange than proper protection for your cables. **THE MOON FUSE TERMINAL** furnishes it.

Lightning, trolley, electric light and all destructive electric currents, as well as the ever-present moisture which is lurking in every city or town, are baffled by the **MOON.** Address

43 SOUTH CANAL STREET, CHICAGO.



Outer Case Opened. Fig. 7.

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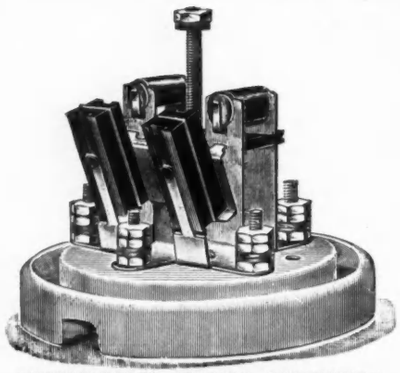
STERLING ELECTRIC COMPANY

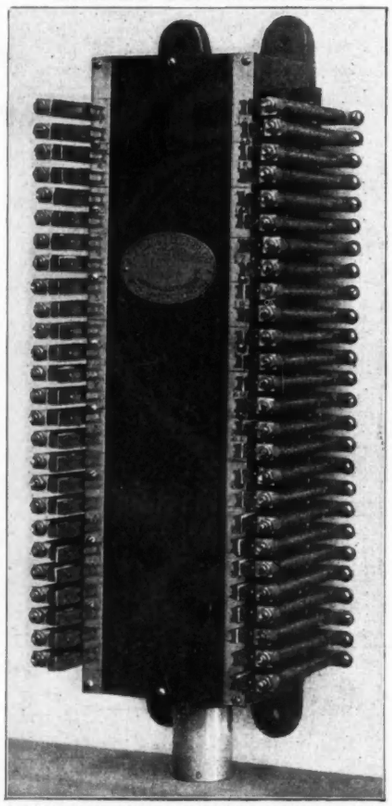
ARE YOU PREPARED

WE POSITIVELY PROTECT AGAINST LIGHTNING TROLLEY

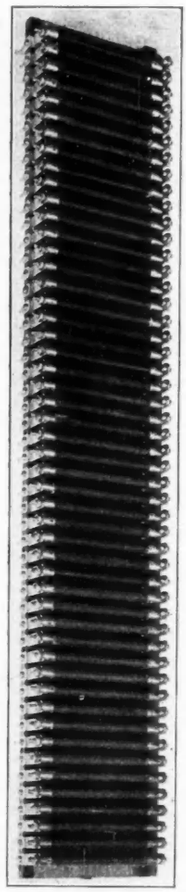


SUBSCRIBERS' STATION PROTECTION.

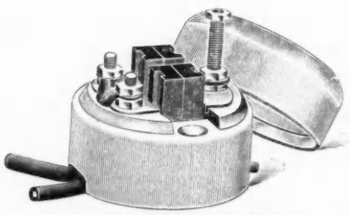
CABLE TERMINALS.



TERMINAL AND COMPLETE PROTECTION FOR CABLES.



MOUNTED FUSES. CABLE PROTECTION.



TOLL STATION PROTECTION.

MAIN OFFICE AND FACTORY:
Lafayette, Indiana,
U. S. A.

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STERLING ELECTRIC COMPANY

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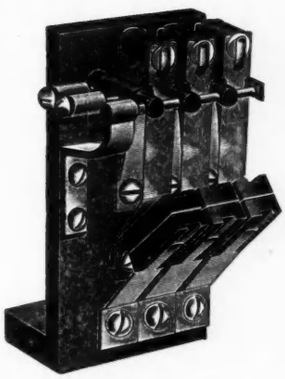
FOR SPRING STORMS?

AND ELECTRIC LIGHT WIRES

STERLING ELECTRIC COMPANY



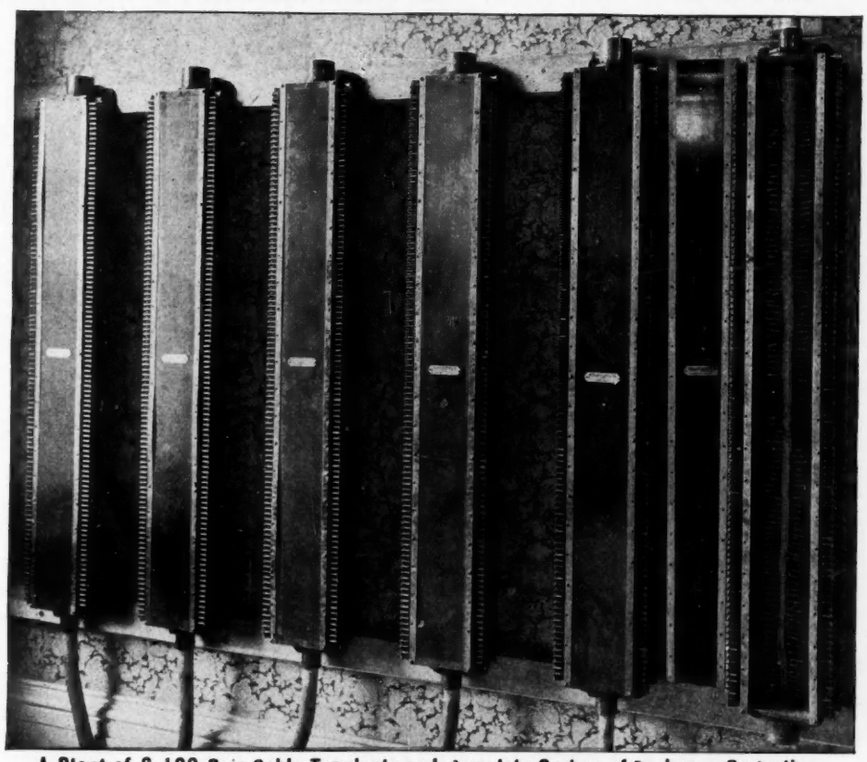
Detail of Complete Protection.

PROTECTORS FOR EXCHANGES

Details of Fuse and Carbon Protection.

CABLES & TELEPHONES

SWITCHBOARDS { MULTIPLE, TRANSFER, TOLL LINE — FULL CENTRAL ENERGY, BATTERY CALLING, GENERATOR CALL.



A Plant of 6-100 Pair Cable Terminals and Complete System of Exchange Protection.

LECTRIC CO.

BRANCH OFFICE:
1260 Monadnock Building,
CHICAGO, ILL.

STERLING ELECTRIC COMPANY

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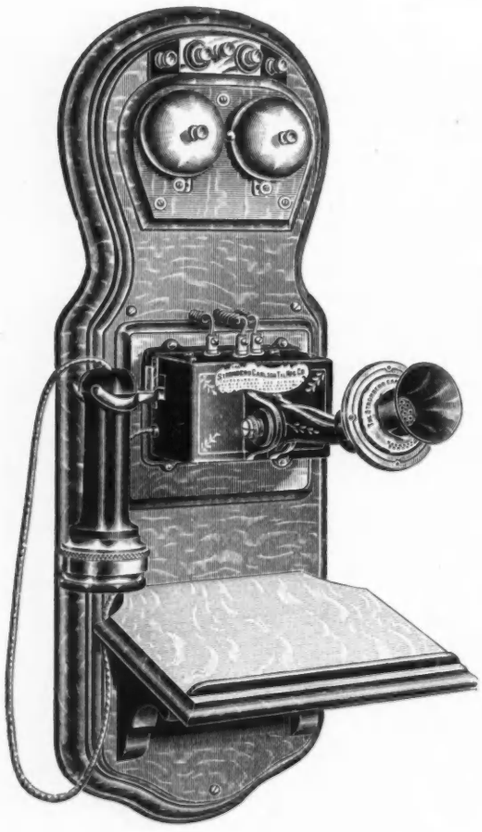
JUDGE BROWN'S DECISION

ON THE

BERLINER PATENT

IN FAVOR OF THE INDEPENDENTS



DEMONSTRATES CONCLUSIVELY

THAT OUR FAITH IN THE STABILITY OF THE

INDEPENDENT TELEPHONE BUSINESS

IN GENERAL, AND THE

"CENTRAL ENERGY" SYSTEM

In Particular, Has Not Been Misplaced.

THE STROMBERG-CARLSON TELEPHONE MFG. CO.

70-82 W. Jackson Boulevard, CHICAGO, U. S. A.

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Telephony.

AN ILLUSTRATED MONTHLY TELEPHONE JOURNAL

VOL. I. CHICAGO. MARCH, 1901. NO. 3.

A MODEL TELEPHONE EXCHANGE.

The Independent telephone exchange recently installed for the Schuylkill Telephone Company at Pottsville, Pa., is of the very latest design, both in system and operation, and can be classed as a model in telephone construction.

SWITCHBOARD SCHUYLKILL TELEPHONE COMPANY, POTTSVILLE, PA.

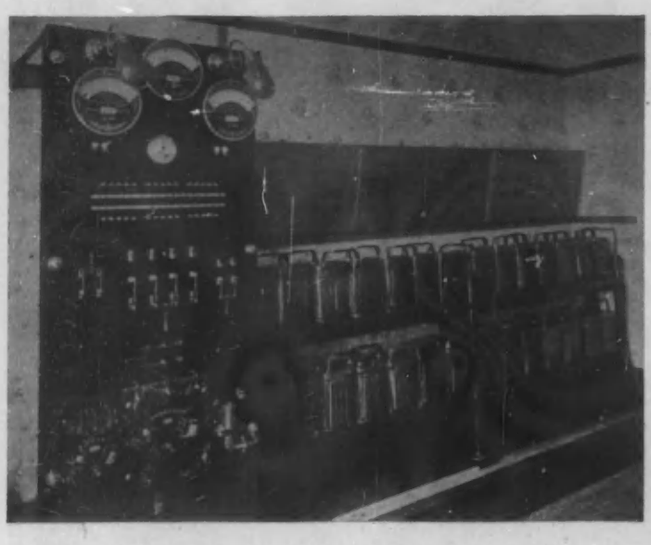
The switchboard apparatus shown above, including the switchboard, chief operator's desk, manager's desk, distributing board, terminal and lightning arrester racks and complete power plant, as also the subscribers' instruments, were furnished by the Western Telephone Construction Company of Chicago, under contract with the Eastern Electrical Construction Company of Philadelphia, who did the entire construction work.

This switchboard is of the multiple central energy type, with mechanical visuals for subscribers' calling signals. These signals are located toward the top of the board and directly in front of each operator. The clearing-out signals, which are miniature electric lights, encased in jack base sockets, with red discs, are located directly in front of the connecting cords on the key shelf. On this shelf are also placed the ringing and listening keys.

The operators' receivers are attached to suitable head bands and are connected with individual cords and plugs. An operator's telephone jack is placed directly below the key shelf, to the left of each operator. This allows an operator to leave the board without removing

her receiver. The act of inserting the operator's plug in this jack closes the local battery circuit for the transmitter. When the plugs are removed the battery circuits are left open.

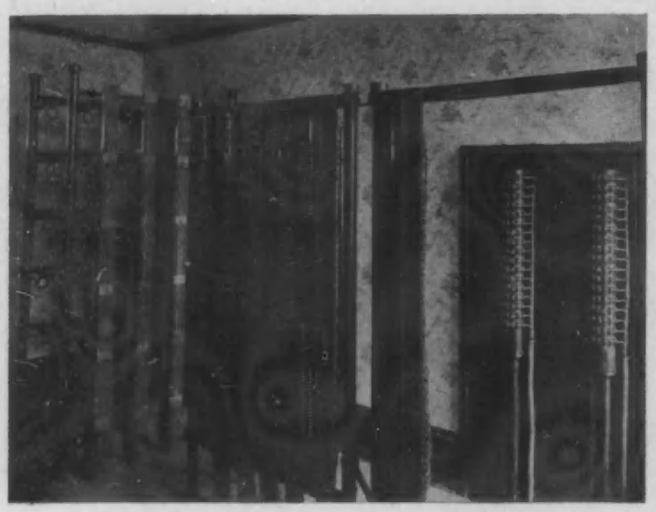
The operation of the system is entirely automatic, with the exception that the operators make the desired connections at the central office. The office is called by



POWER BOARD, SCHUYLKILL TELEPHONE COMPANY.

removing the telephone from the hook, raising a visual signal within view of the operator. This signal has the corresponding number of the telephone from which the subscriber is making the call. Each operator has 100 signals. When any of these signals are operated, a pilot lamp of ten-candle power lights, which tends to insure attracting the operator's attention.

When the operator inserts the answering plug into the answering jack, the visual restores to its normal position and the pilot lamp ceases to burn. The operator throws the lever of her key over, making connections



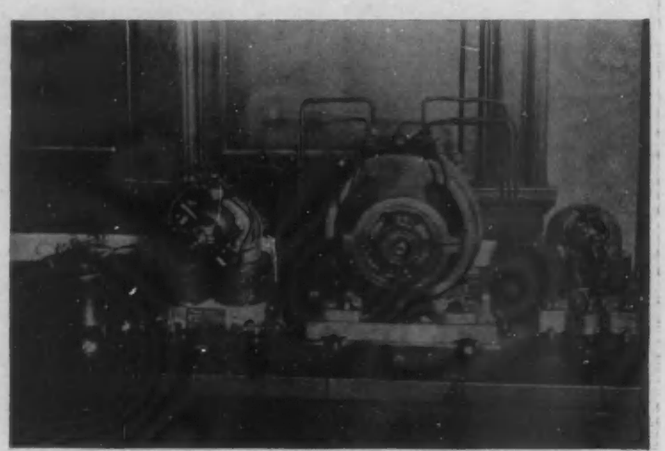
PROTECTIVE SYSTEM, SCHUYLKILL TELEPHONE COMPANY.

with the subscriber's line. After inquiring for the number desired, the operator takes connecting plug, and, having the lines duplicated directly in front of her, makes the desired connection without the assistance of any other operator. Before the operator inserts a plug in the multiple jack, she brings the tip of the plug in contact with the shell of the multiple line jack and touches it, pausing an instant. If she does not receive a "click" in her receiver she knows at once that the line is not busy and inserts the plug and then rings the subscriber by pulling the key lever toward her. If a subscriber's line is busy when called for, the operator will receive a "click" in her receiver, which gives her an absolute busy test.

When the subscribers have finished the conversation and wish to be disconnected, the act of hanging the receiver upon the hook lights the miniature electric lamp, which gives the operator a positive signal to disconnect the line. It is impossible to light this lamp without replacing the receiver upon the hook. A subscriber can attract the operator's attention at any time by simply moving the receiver hook up and down, which flashes the supervising or clearing-out light, showing that the subscriber wishes the operator to come in on the line.

This switchboard is a departure from the old class of multiple central energy switchboards, inasmuch as the division of the multiple jacks has been reduced to such an extent that it is possible to use seven panels for multiple jacks, thereby reducing the reach about six inches over the old-style six-panel boards.

The wiring and circuits of this system are very



POWER GENERATORS, SCHUYLKILL TELEPHONE COMPANY.

unique, as in the operation of the subscribers' lines there are absolutely no contacts, and no line relays are used in the entire switchboard.

The present switchboard is of 1,200 capacity, with 600 subscribers' lines equipped. There are at present cabinet and framework enough to equip this switchboard to 700 subscribers' lines. This switchboard can be used, without making any change in the wiring whatever, for party line systems.

One of the many features of this system is that when additions are required the new lines can be installed and the additional multiple cables put in without cutting or splicing out any of the present equipment. This enables additions to be made very easily and without interruption to the telephone service.

The finish of the switchboard and other apparatus coincides with the other furnishings of the office, which are of antique oak.

A 1,000-line capacity distributing board has been installed, equipped for 800 lines. The well-known Rolfe combination fuse lightning arrester device is used for protection against lightning and sneak currents. The framework for a capacity of 1,000 has been installed, 600 being equipped.

The power plant installed includes two sets of 300 ampere hour American storage batteries. These storage batteries are mounted upon an iron rack with slate base, the jars being set in wooden trays filled with white sand

and set up with insulators, insuring against leakage. The lugs of the storage batteries are burned together in a very permanent manner.

The power board as shown, which is of black marble, has the ammeters, voltmeters, bus bars, switches and rheostats mounted upon it. With these various switches the power plant is completely controlled, the apparatus on this board being so wired up that readings can be taken at any moment of the condition of the batteries, charging machines and power leads, showing the condition of the different circuits.

The charging and ringing machines as shown, are of the Roth Bros', (Chicago) manufacture.

There are two separate ringing generators, one of which runs from the 110-volt power circuit, the smaller

COMMON BATTERY TELEPHONE, SCHUYLKILL TELEPHONE COMPANY.

one being an auxiliary machine which runs from current supplied by the local storage battery. The switches are arranged on the main switchboard, so that this machine, which is used during the night, is only run when an operator wishes to ring a subscriber, the charging machine being a combination motor generator of two-horsepower.

This is probably the most complete central energy telephone exchange which has been installed up to date. The entire construction work, both in and out side, was done under the supervision of Mr. Wm. Helfenstein, acting for the Eastern Electrical Construction Company.

The Eastern Electrical Construction Company are now building telephone exchanges for Williamsport, Pa., and Binghamton, N. Y. These switchboards are similar in construction to the Pottsville board, with the exception that the Binghamton, N. Y., switchboard will be of miniature lamp line signal type.

The contracts for the apparatus for these towns have been closed with the Western Telephone Construction Company.

The chief operator's desk, shown in cut is equipped with all the necessary apparatus to allow the chief to thoroughly supervise every operator in the exchange.

Small miniature lamps are provided that operate in unison with the corresponding pilot lamp in the main switchboard. By this means the chief operator can watch the service while at her desk, and know that calls are answered promptly. Having a jack for each operator's position located directly below the corresponding miniature lamp, enables the chief operator to listen in on any of the operators' circuits which she may desire.

This desk consists of a flat top, handsomely finished antique oak desk with a cabinet containing the operator's set upon same.

The common battery instrument as shown is the telephone used in this system. In design, construction, finish and simplicity they are hard to equal.

These instruments are so made that by unlocking the top shelf the front of instrument can be entirely opened, bringing to view all the apparatus in the telephone.

The condensers, which are in a metal case, are perfectly dampproof and rest in a small pocket attached to the instrument, which also tends to improve the appearance. They are so located that they can be readily inspected without removing the telephone from the wall.

These instruments are equipped with a hollow rocker arm and Western transmitter, mounted on a suitable iron box, neatly striped. The transmitter connections in this type of rocker arm are entirely concealed. Each instrument is also equipped with a carbon plate lightning arrester located at the top of the instrument, which, with the other protective devices used, insures against destruction by lightning. These instruments are also equipped with the new "Western" receiver, with the convex perforated center caps, making in all a splendid appearance.

IOWA TELEPHONE ASSOCIATION MEETING.

The fifth annual meeting of the Iowa Telephone Association will be held in the club rooms of the Savery Hotel at Des Moines, Ia., on Tuesday, March 12, 1901, at 2 o'clock p. m., for a two days' session.

It is urgently requested that every member be present. The program for this year's meeting is being prepared by the committee, who will be pleased to receive any suggestions from members who desire special subjects discussed. Address all communications on this subject to Chas. C. Deering, secretary, Boone, Ia.

Attention is called to the map of the Independent telephone lines of the state, prepared under the auspices of this association, and now being distributed by O. H. Carpenter of Iowa City. It is extremely important that this map should be made and kept accurate. Exchange men are requested to notify Mr. Carpenter of all extensions made during the past year in order that they may be properly mapped.

It is desired to make this the largest and best meeting ever held by the association, and the co-operation of every member is needed to accomplish this.

One of the most important questions to be discussed at this meeting is the matter of checking reports and making settlements between companies for interline toll business. Attention is called to this in order that a full discussion of the subject may be had. Another very important subject which will be discussed at this meeting is "Farmers' Lines," their construction, equipment and the rates to be charged, etc.

A new use has been found for the telephone in Indianapolis, where subscribers arrange with the central office to be called in the morning, as at a hotel, the telephone bell serving as an alarm clock. Sometimes, too, the obliging central office is asked to ring regularly through the night, at intervals of an hour or two hours, as the case may be, to give notice that it is time to take medicine.

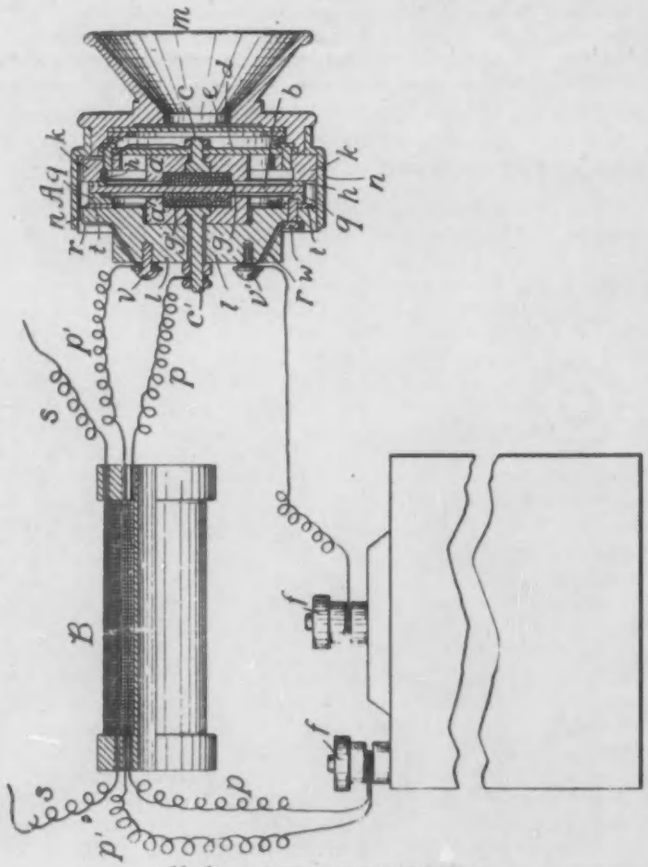
DIGEST OF TELEPHONE AND KINDRED PATENTS.

CONDUCTED BY EDWARD E. CLEMENT.

JANUARY 8.

665,639—T. Iwata. Telephone Transmitter. (A copy of this patent could not be obtained in time for the last number.)

This is the invention of a Japanese gentleman, and the attorney is also Japanese—by name Takamine. The case is very ably drawn. The device set forth is a double acting granular transmitter, working with an induction coil having a double primary. In the figure the mouthpiece and shell are of ebonite or similar material. The diaphragm is of carbon, working between two cups, a and a', also of carbon, containing granular material. One cup, a', is carried on a solid back block l, while the other, a, is supported by a bridge piece d, secured across the inner face of the front part of the shell. The diaphragm is connected to one side of battery and the two cups, a and a', in parallel to the other side of battery through the two primary windings



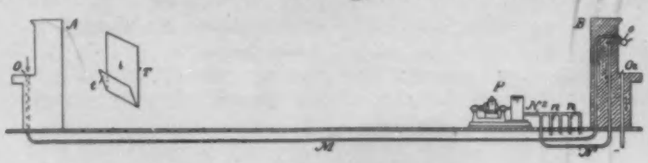
665,639—TELEPHONE TRANSMITTER.

of coil B. These windings are oppositely connected, so that as a movement of the diaphragm simultaneously strengthens current in one branch and weakens it in the other, the changes tend to augment each other's effect on the secondary. Paper and brass rings confine the diaphragm, which is protected from moisture entering the mouthpiece by a membrane e, loosely stretched across the inside of the mouthpiece, with a slight clearance.

JANUARY 22.

666,444.—G. K. Thompson and E. C. Robes. Telephone Exchange, Central Station Switchboard Apparatus.

This is an odd departure from the electrically operated apparatus usually employed in telephone work. The invention lies in a system of pneumatic transmission of messages. It is to be used particularly in connection with toll boards. A call for toll line connection is received at one of the ordinary sections by an answering operator, who makes out a ticket with the number calling, the number called, the

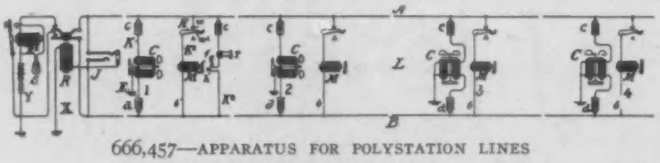


666,444—CENTRAL STATION SWITCHBOARD APPARATUS.

time, etc. This ticket must be conveyed to the toll board, where the desired connection is made, and from there to a central repository for record. The scheme here adopted is that of pneumatic tube transmission of the tickets, but without any carriers, as ordinarily employed. A thin tube, rectangular in cross section, is employed, and the ticket is folded over, as shown in the figure at Tt, and slipped into the tube M by operator at answering board O, atmospheric pressure then serving to carry the paper through the tube to toll board B, where the air is being constantly withdrawn from the tube by an air pump P, through a valve o, by which it is controlled. When the ticket has served its purpose at the toll board it is again slipped in a tube by the opening at O^2 for transmission to the book-keeping department.

666,457.—J. A. Barrett. Privacy Device Apparatus for Polystation Telephone Lines.

This is a "lockout" for party lines, adapted particularly for central battery systems. The apparatus employed is not very elaborate, and the diagram fairly well illustrates the idea involved. At each station a magnet M is employed, having high resistance, controlling a drop shutter t, which, when down, bridges a pair of contacts g h, just as the ordinary drop annunciator closes its night bell circuit. When the hook H rises it simply connects this magnet M



666,457—APPARATUS FOR POLYSTATION LINES

across the line wires A-B, and if the line is not in use, i. e., if the main battery at central is connected, current will flow therefrom to energize the magnet and throw down the shutter. The shutter contacts g h are included in a second bridge of the line wires, containing the telephone transmitter and receiver, symbolized at T. On the other hand, if the line is in use the main battery is cut off by the central office relay R^2, as usual in the Bell "relay" systems, and so the magnet M receiving no current, the telephone remains disconnected. A visual signal is displayed to indicate this condition of "line busy," consisting of a small target behind an opening.

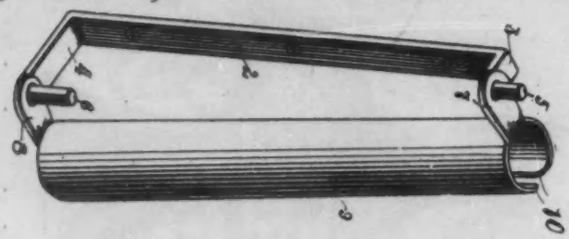
666,674.—I. S. Hoffmann. Telephone Directory Holder.

This is a clamping holder for a directory, consisting of a back plate 2, for attachment to the wall or other support, with two arms, 3 and 4, the latter larger than the former, carrying pintles 5 and 6, on which is pivoted a split tube 9, divided as shown at 10, to receive the directory.

666,675.—G. L. Hogan. Telephone.

This is a form of telephonic relay system in which a single transmitter 1 acts through a coil 5 and circuit 6 on

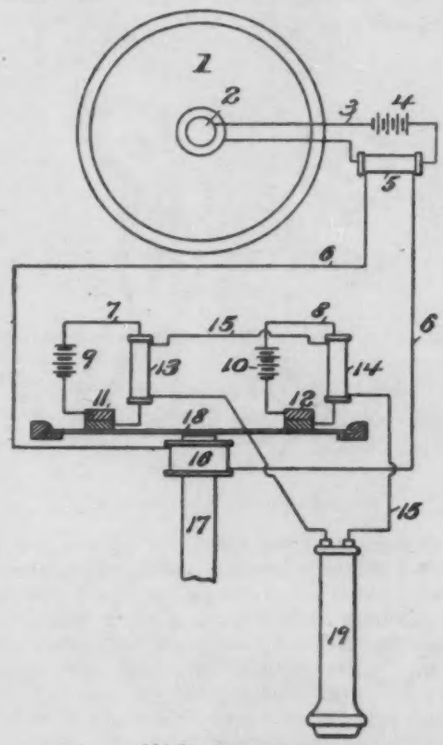
a receiving magnet 16-17, which actuates a diaphragm 18 to affect two transmitters or two pairs of contacts 11-12, which through their coils 13-14 and circuit 15 react on a single receiver 19.



666,674—TELEPHONE DIRECTORY HOLDER.

666,677.—A. G. Holcombe. Microphone.

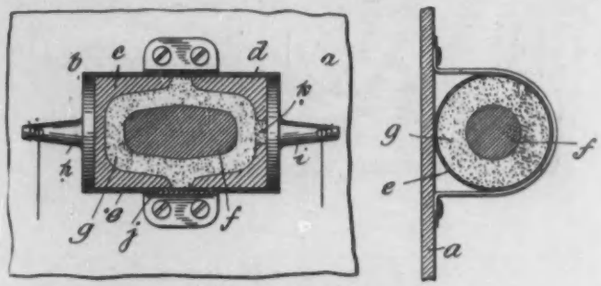
This is a transmitter of the carbon pencil type, but with granular carbon between the solid elements. The complete resistance varying device consists of two solid cups, c and d, supported in a shell e, and having between them a third solid member f, surrounded by a mass of granular carbon g. The entire device is mounted on the diaphragm a, as by the band shown, so that the movements of the diaphragm and the inertia of the member f cause changes of pressure in the granular mass. The circuit wires are connected to the ends at h and i. A number of these devices may be mounted by their ends h-i, between conducting plates carried on the diaphragm, and all connected in parallel.



655,675—TELEPHONE.

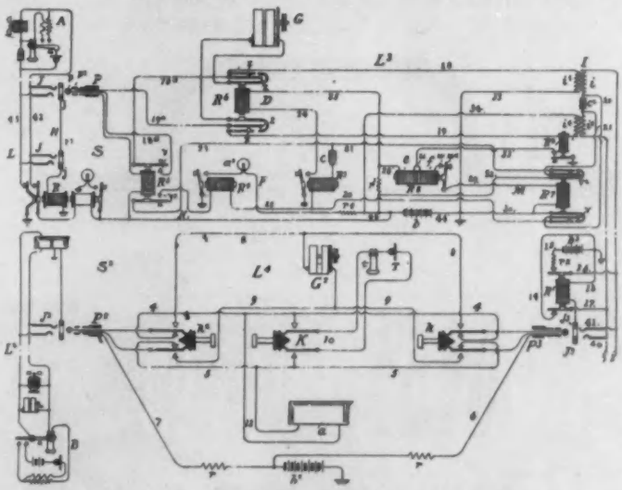
666,698.—M. C. Rorty. Telephone Exchange Circuit and Signaling Apparatus.

This is a scheme of circuits and apparatus for passing signals between an answering operator, the calling subscriber, a toll board operator, and the toll line subscriber. The inventor well says that most of the active signaling appliances are grouped at the calling end of the trunk. He employs no less than seven single-wound relays, a differential "sluggish" relay, a bridged high-wound drop, three batteries and two power generators, to work his signals. Three of the relays work multiple contacts. The operation is simplicity itself. The calling line L is supposed to work on common battery, with the usual supervisory relay R^2 in series with the talking circuit. L^2 is the trunk, having a terminal plug P at the switchboard S, and a jack J^2 at the toll board. 4, 5, 6 are the conductors of a connecting cord at the latter board, whereby the trunk is connected with the toll or other magneto line L^3. The conditions then are: Subscriber A, on line L, must be able to signal operator S^2, who has ordinary bridged annunciator a; operator S^2 must be able to ring both subscribers A and B (the latter over line L^3), and must also be able to signal operator S to disconnect. As this system is little likely to come into popular use, detailed explanation is unnecessary,



666,677—MICROPHONE.

so merely a sketch will be given of the action of the numerous relays and signals. In ringing forward, operator S^2 uses key K^2 in the usual manner, and reaches the subscriber B on line L^3 direct. In ringing back current from generator G^2 energizes relay R^3, which works multiple contact relay R^4, which puts current from generator G on line L. While subscribers are talking, current flows from battery b to line L through relay R^2, which keeps circuit 31 closed through one side, e, of differential relay R^3, and its armature w^3, pulled up. This keeps the circuit M of the neutralizing coil f closed, but as it is shunted by wire 31 it receives a negligible amount of current. When the subscriber A hangs up relay R^2 breaks circuit 31, and relay R^4

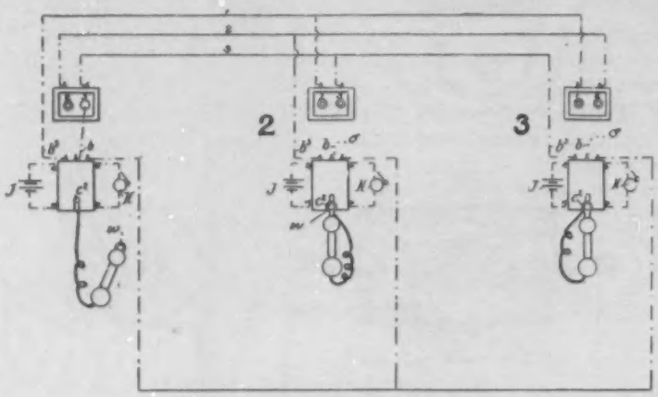


666,698—CIRCUIT AND SIGNALING APPARATUS.

gets current from battery b through its coils in series, they neutralize each other as regards the core, and armature w^3 falls off. It falls very sluggishly, however, and before its mind is fully made up magnet R^1 has had current long enough to be energized and connect battery b back on to the trunk conductors to throw drop a at station S^2, thus telling the toll board operator that subscriber A has hung up. Subscriber B can ring off as usual. During the complete connection relay R' has kept battery b^2 disconnected. When plug P^2 is removed from trunk jack J^2, however, this relay is de-energized, and current from battery b^2 goes back over the trunk to energize relay R^4, and light lamp a^2, as a hint to the operator at S to disconnect.

666,874.—P. Rabbidge. Arrangement of Switching Appliances in Connection with Telephones.

This is an intercommunicating system, using plugs and jacks, common return circuit, and combination instruments. Each station has its own battery, and the ringing or talking require the joint operation of a switch in the handle of the telephone and a sliding switch in the front



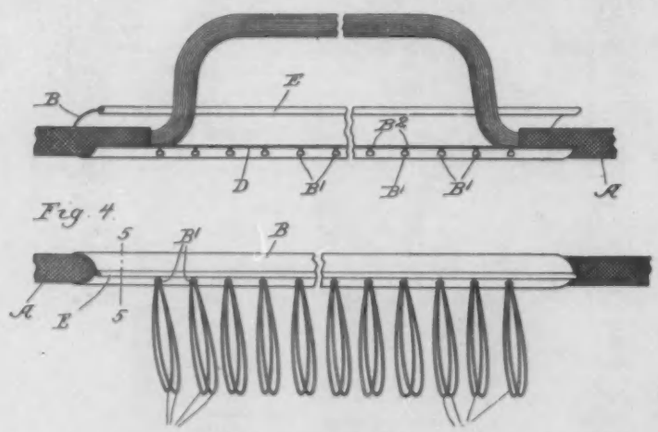
666,874—SWITCHING APPLIANCES.

of the jack receptacle, upon which the telephone is hung when not in use. When private conversation is desired each station operator plugs in on his correspondent's wire and both place their switches in an intermediate position, there being then established a metallic circuit, upon which, supposedly, no one can intrude, and connection with the common return being broken.

FEBRUARY 5.

667,195.—T. V. Davis. Telephone Switchboard Connection.

A cable casing for multiple switchboard cables, made of fiber or other tough insulating material. The cable section from which loops are to be taken out, is stripped and the loops are laid in the slots B', shown in the edge of

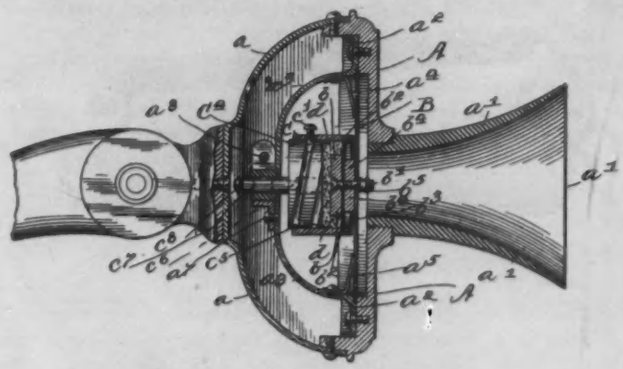


667,195—SWITCHBOARD CONNECTION.

the casing. When all the ends are thus laid and the whole mass smoothed down, the casing is closed and the edges interlocked, as shown in the lower part of the figure. Paraffine and other insulation is thus rendered unnecessary, and the stripped portion thoroughly protected, while the spaced slots B' obviate the necessity for forms.

667,327.—T. Lidberg. Telephone Transmitter.

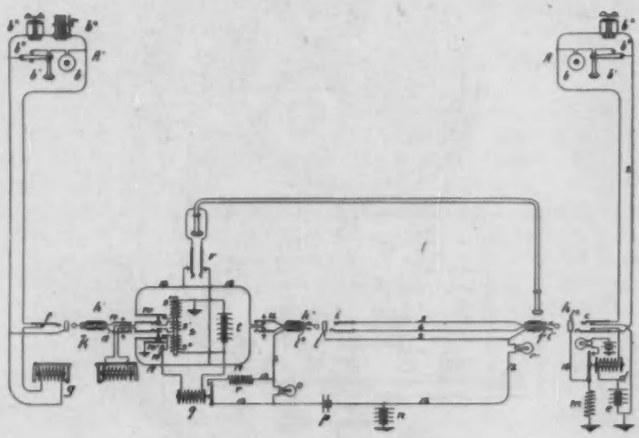
This is a transmitter very nearly like the White instrument. It has a cylinder C, with a counterbored front end to receive a mica diaphragm, over which the edges of the cylinder walls are spun down to hold it. The front electrode b is carried on this mica diaphragm. The rear electrode has a round-bottomed thread cut in it, and there are three or more screws, c^3 c^3 c^3 in the cylinder to take into the thread and not only serve to furnish abutments to move against, but also as locking screws.



667,327—TELEPHONE TRANSMITTER.

667,448.—F. R. McBerty and J. L. McQuarrie.

This is an arrangement of signals for trunk lines from toll boards to subscribers' switchboard sections. A' calls by a magneto current through annunciator g. Operator K connects jack f with trunk jack i by means of cords 16-17 and plugs L' K'. Battery t is bridged between coils s^3 s^3 of one side only of repeating coil S, the other coil, s', being connected back through keys w and 14 to station A'. Subscriber A being called for, the operator at h receiving the order over the order circuit shown, completes the connection by placing plug i' in jack c. This completes cir-



667,448—TRUNK LINE SIGNALS.

cuit from battery t in the cord out to line 1-2, and also circuit 9-11-12 through lamps o and o', also circuit n-12-10-m, grd., from battery n through lamp o'. The latter has no effect on lamp o', however, as the batteries n and p are opposed, and the difference in potential is not sufficient to light the lamp. Current from battery p lights lamp o, however, showing operator at K that the connection is complete. When subscriber A answers, current from battery t flows out and energizes relay q, which closes shunt 13 around lamp o, and thereby extinguishes it.

When subscriber A hangs up lamp o relights to clear out, and when plug k is withdrawn from jack i lamp o' lights, as battery p no longer opposes battery n, thus signaling disconnection to operator at h.

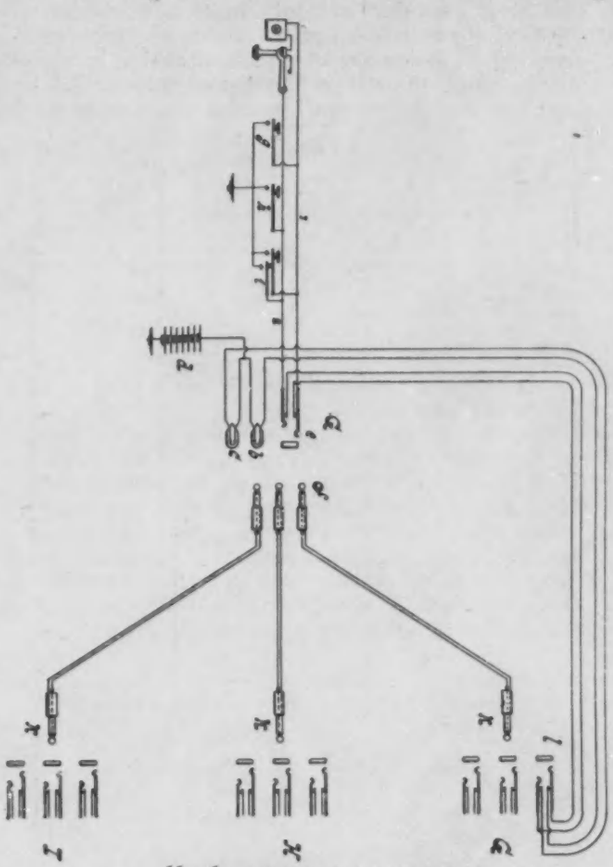
FEBRUARY 5.

667,460.—C. E. Scribner. Telephone Exchange Apparatus.

This is a scheme of circuits whereby a subscriber may indicate to the answering operator by a visual signal the group or location of the terminal device of the line he wishes connection with. That is, the calling subscriber

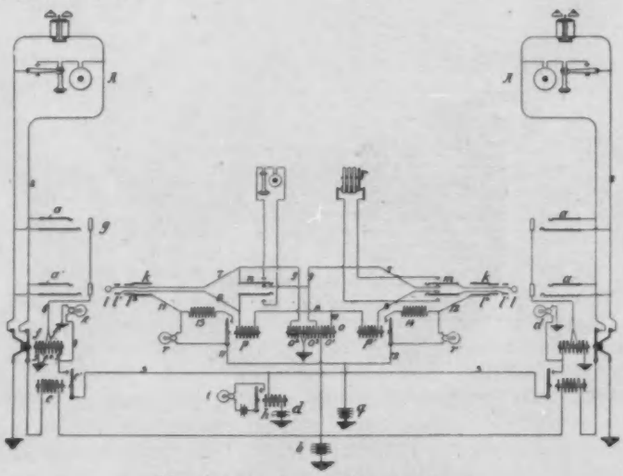
may indicate that he desires to be trunked to exchange No. 1, 2 or 3, by corresponding visual signals, without speaking. The only object of the invention is to expedite connection and save the necessity of repeating the number.

In the diagram the subscriber at the left of the figure



667,460—EXCHANGE APPARATUS.

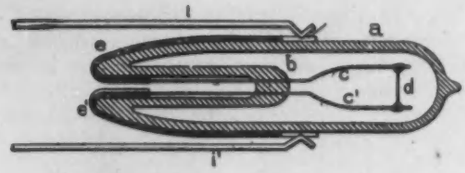
has three keys, one of which, g, when depressed completes a circuit by wire 7 to lamp b and battery d, this indicating to the operator that he wishes a connection on board G; a second key, h, completes circuit of lamp c, to indicate board t; while the third key lights both lamps, to indicate board K.



667,461—SWITCHBOARD APPARATUS.

667,461.—C. E. Scribner. Apparatus for Telephone Switchboards.

This is a system intended primarily to guard against the accident of a broken line lamp signal, the existence of such a defect announcing itself. In the diagram the well-known "relay" system of the Bell Company is shown, having line signal relays c, cut-off relays f², line lamp e, pilot lamp i, with its relay in a common battery wire from a group of line lamps; supervisory lamps r-r', each adapted to be shunted when its line is in use by a relay p or p', responsive to current from bridged battery q. The gist of the present invention lies in making the cut-off relay double wound, and putting one winding, f', in series with the line lamp e, and to ground. If the line lamp is broken the pilot lamp i will light in response to the line call, the relay getting current over the following path: Battery N, wire 3, armature c', wire 5, coil f' and ground. If a call-



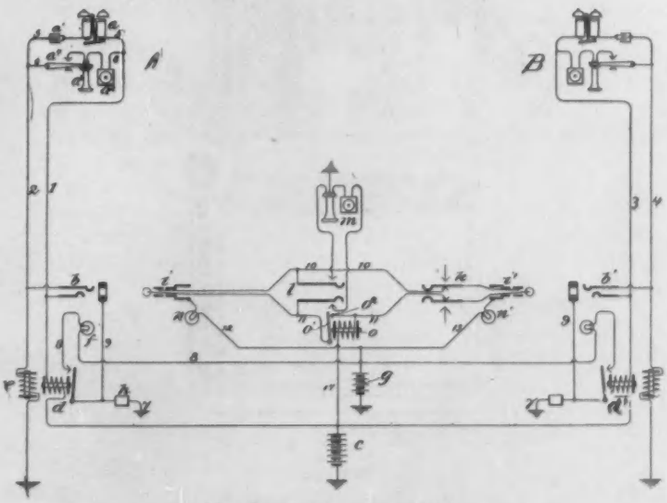
667,462—SIGNAL LAMP FOR SWITCHBOARD.

ing plug be inserted in a jack, whereof the signal lamp is broken, the supervisory lamp r' will not light brightly, but will be dimmed, inasmuch as its circuit is the following: Battery q, wire 12, lamp r', plug k', jack thimble and to cut-out relay coils ff' in multiple, wires 5 and 4 (through lamp e) to ground. If branch e is open, of course the current is reduced in wire 12 and the operator notes the trouble.

667,462.—C. E. Scribner. Signal Lamp for Telephone Switchboard.

An incandescent lamp made of two tubes, an inner and an outer, with contacts e-e' of sheet metal, bent around as shown, soldered to leading-in wires within, and notched without the tubes. The notches take end of the jack springs i i' and prevent the lamp from turning in its socket, a source of much trouble in the past.

667,463.—C. E. Scribner. Signaling Apparatus for Telephone Switchboards.



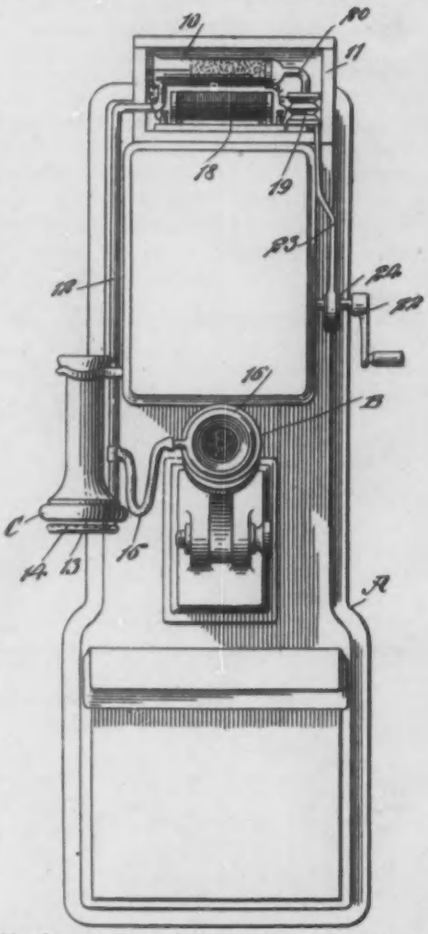
667,463—SIGNALING APPARATUS.

This is a very ingenious arrangement of circuits for common battery "relay" type switchboards, using neither repeating coil nor condenser in the cord, but nevertheless having independent supervisories. One side of the cord circuit 10-11 is normally open at relay contact o², and cannot be closed except by current in the called line when the called subscriber answers. Prior to that the lines are not joined, and hence their line relays d and d' act independently. Each relay lights a lamp f for a call, and each lamp f is brought into multiple with a supervisory lamp n or n', when a plug is inserted in the line

jack, battery g being the source of supply. Obviously the subscriber, by working his hook, can control his line relay d to cut in or out his line lamp f, and so extinguish or light the supervisory lamp n. This action is independent at first, for current cannot flow across from one line to the other because of the break at c^2. When the called subscriber at B has answered, however, current flows from battery c to line 3 and back by 4 to ground, whereupon relay c pulls up its armature to close the cord break, and thenceforth the signals n and n' are not independent; but both subscribers A and B must hang up before the lamp n n' will show.

667,484.—C. F. Axtell. Device for Disinfecting Telephones.

This invention contemplates the use of an ozone generator and means for discharging ozonized air into the transmitter mouthpiece. The generator is a Siemens ozone tube mounted on the top of the magneto box and connected on one side to a small bellows worked by an eccentric on the crank handle of the generator; and on



667,484—DEVICE FOR DISINFECTING TELEPHONES

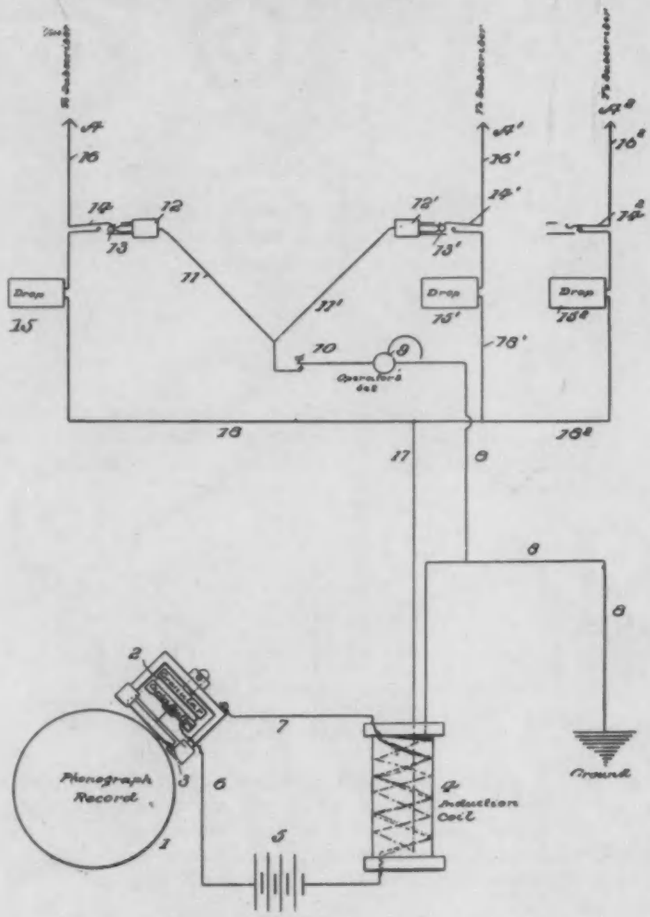
the other side to a perforated ring 16 in the mouthpiece. Generator current in the primary of a coil 18 produces a suitable ozonizing discharge through the secondary and to the tube.

667,503.—A. B. Clark. Phonograph Attachment for Telephone Circuits.

Mr. A. B. Clark must have experienced some long delays, on the European plan, in obtaining telephone connections; for he aims in the present case to furnish subscribers with the news, advertising matter, music, etc., while they wait for the operator to answer their calls. This is to be accomplished by connecting the phonograph with a microphone transmitter attached to all subscribers' lines back of the line annunciators, so all that need be done to get the entertainment is to take the receiver from the hook. Each line is cut off from the phonograph extension when a plug is inserted, so the continuous performance feature will not interfere with ordinary use of the system.

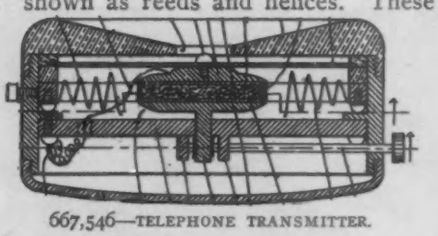
667,546.—L. Mellett. Telephonic Transmitter.

This is a granular microphone of a common type, scarcely likely to have been given trial in the form shown. The diaphragm carries one electrode, a bridge in the rear part of the shell, the other two being surrounded by a felt ring; but the gist of the invention consists in having



667,503—PHONOGRAPH ATTACHMENT.

arranged radially around the inside of the shell a set of "vibrators" shown as reeds and helices. These are sup-



667,546—TELEPHONE TRANSMITTER.

posed to respond by sympathy to certain tones, and by communicating their vibrations to the electrodes, to strengthen the transmission.

FEBRUARY 12.

34,084.—(Design.) R. V. Griggs. Bracket for Telephone Stands.

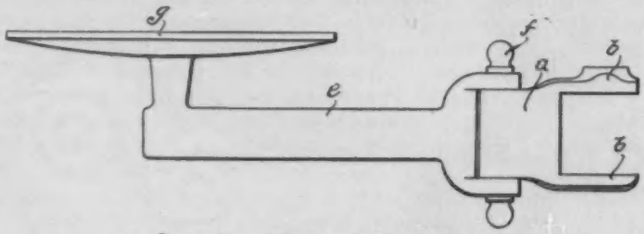
A bracket for desk sets in the shape shown.

668,044.—F. L. Gilman and C. H. Herzig. Telephone Switchboards and Circuit.

This invention is intended to remedy a very common

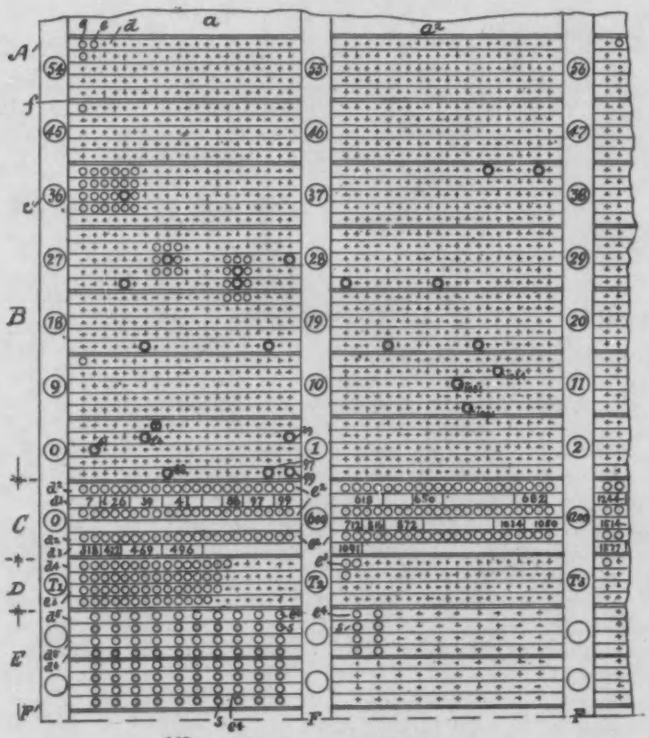
and annoying condition, viz.: The assignment of different numbers, with all that this entails in switchboard location, etc., to several lines to the same subscriber. Probably everyone has experienced the annoyance of calling one different number after another, at a busy time, when all the time it is but one party he wants. The operator must also experience annoyance, as she must test the lines, and proceed in every case as if it were a separate subscriber.

In carrying out the invention one of a plurality of



34,084—BRACKET FOR TELEPHONE STANDS.

circuits to one sub-station terminates at the switchboard in all respects as is usual. Its regular switch socket is located according to its number, and its conductors are multipled to switch sockets on the several sections, and the circuit is provided on one section with an answering jack and a line signal; but each regular multipled switch socket of the circuit is provided with some visible designating configuration, color or character upon the end thereof seen upon the front of the switchboard, which signifies to the operator that it is different from other regular switch sockets and is special to sub-stations having more than one independent circuit to the switchboard.



668,044—TELEPHONE SWITCHBOARD.

Upon some part of the switchboard, preferably in a space extending the length of the switchboard between the banks of trunk or toll line switch sockets and the banks of the regular sub-station switch sockets, are arranged strips of sockets alternating with blank strips adapted to hold a number card. This space we denominate the "special space" and the switch sockets the "special switch sockets." The remaining circuits of the plurality of circuits from the sub-station are not represented by switch-sockets upon the regular switch socket space of the switchboard, but the conductors thereof are connected and multipled to special sockets on the special space, all of the said circuits being connected to sockets in proximity to each other in the same insulating strip, and beneath the said switch sockets upon the card on the blank strip is placed the same number that is given to the regular circuit referred to as located in the strip in the regular switch socket space. Thus all of the circuits belonging to one sub-station have the same and identical number, one of them having its switch sockets multipled with the regular or single sub-station circuits in the banks at the upper part of the switchboard with an answering socket and signal, with the roups of sockets and signals at the lower part of the switchboard, as usual, while the remainder of the circuits are multipled in the special space mentioned and may, or not, be provided with answering switch sockets or with line signals. Means are also provided whereby additional special switch sockets representing other circuits to the sub-station can be added to those already located together in the special strip of such sockets and be embraced or included under the same common or identical number.

TELEPHONY IN GREAT BRITAIN.

The National Telephone Company, profiting by the experience of the telephone system in America, particularly in San Francisco, intends to extend its operations in Great Britain in a way that will bring the benefits of telephone communication within the reach of a much wider circle than at present. The company is prepared to fit up and maintain telephonic instruments on subscriber's premises on the party-line system. The cost of service is collected at the time by an ingenious arrangement on the penny-in-the-slot system, hence there is no account to meet monthly or quarterly, as the case may be, and all liability is confined to the following rates: Two dollars and 50 cents a month for each subscriber on a two-party line, $2 on a four-party line, and $1.25 on an eight-party arrangement. Under this last head the total cost works out at $15 per annum.

Owing to the many complaints made by subscribers of the delays in getting connection with places in the country, the National Telephone Company has communicated with the postoffice in hope of remedy. The response, however, is to the effect that a minimum of 20 minutes must always elapse before any reply can be made as to when a call for a telephone district outside the metropolis will be answered. It is believed that an insufficiency of trunk lines and a lack of employes are responsible for this new and vexatious regulation, which is certainly not a hopeful augury for the coming Postoffice telephone system.

ILLINOIS TELEPHONE MEETING.

A meeting of Illinois telephone men was held in Champaign, Ill., on February 6, 1901. Following is the list of attendants: E. S. Sterrett, Henry; P. D. Myers, Chicago; M. E. Grant, Wenona; C. O. White, Princeton; John W. Gay, Mattoon; G. F. Haworth, Danville; E. H. Alexander, Champaign; Perry W. Warner, Rossville; B. F. Wasson, Farmer City; A. O. Harrison, Sullivan; George B. Spiller, Mt. Zion; R. L. McOuat, Indianapolis; A. O. Einstein, Indianapolis; W. E. Doolittle, Sterling; O. B. Chamberlain, Hoopeston; D. F. Holliday, Indianapolis; Oscar Bonnett, LeRoy; A. J. Kusel, Chicago; John Woodin, St. Joseph; A. B. Glascock, St. Joseph; D. C. Morrissey, Champaign; J. H. Davis, Danville; C. C. McElwee, Sidney; H. J. Kusel, Chicago; E. Van Sickle, Dana, Ind.; Geo. W. Fair, Chrisman; O. K. Benton, Isabel; George W. Hughes, Hume; J. A. Seybold, Sidell; Warren Stoddard, Monroe, Mich.; U. S. Thompson, Fithian; W. H. Ramsey, Auburn; Carl J. Schlesinger, Chicago; C. W. Shimel, Casey.

PROTECTION AS RELATING TO TELEPHONES AND TELEPHONE PROPERTIES.

BY WILLIAM E. DOOLITTLE.

This is a subject that is worthy of thought and consideration, as no matter how good the apparatus employed, without protection it is always subject to the freaks and caprices of the elements, and in cities is subject even to a greater danger than from the elements, and that is the danger of contact of wires with those of a high potential or electromotive force.

Reviewing the advent and progress of protection in connection with telephones and telephone properties. In the earlier days of telephony there was practically no protection used. One of the first forms known was composed of a brass strip for a ground plate, over which were brass discs, separated from the plate with paper, the telephone line being connected to the disc. This was followed by what is known as the saw tooth, which was two brass plates with saw tooth edges placed as closely together as possible without touching. One plate being grounded, the lightning was supposed to arc across the space to ground. Some of the earlier instruments were supplied with a ground plate upon the top with a projecting spring from each binding post, which carried an adjustable screw, which was set with the point as close to the ground plate as possible.

The first movement in the direction of the use of carbons was for toll line protection, in the days of the old grounded lines, the inspectors taking two discarded battery carbon plates having the lead heads with screw attachments, insulating the two with paper and tying tightly together with string. These were very successful and used largely through Ohio, Indiana, Illinois and Iowa. This was all before the advent of electric light or trolley wires.

With the introduction of these new dangers came the urgent necessity of doing something by way of better protection. One of the earlier forms was the electro-magnet protection in various different mechanical forms which served to either open the line or ground the line. These were extensively used, but in later years have all been discarded. Some of the earlier forms of protection, or attempted protection, against this new dangerous enemy of the telephone and apparatus, were a twisted pair of silk wires in each line, one side of the pair being a ground wire and the other the line. Another was the Wilson arrester, this being a fine wire from two terminals through the point of a spring drawn tight over an upright rubber, or glass, the springs having a prick point contact to ground when not held away with the fine wire. The action of lightning or high-tension current would fuse the wire, allowing the springs from their own tension to ground the line. Another was the cutting into each line of a piece of fine wire, which was drawn tightly across a mica-covered brass tube, the tube being aground. The fine wire would supposedly open from a high-tension current or the lightning arc to ground. Another was the insertion of a spiral of insulated German silver wire; and still another was the insertion of a piece of fine insulated wire into each circuit, the same being wrapped tightly around a metal post. This post being grounded, lightning would arc to ground and often destroy the wire, while high-tension currents were supposed to use the wire, either grounding or opening the same. All of these experimental forms of protection were taken up in the Bell service and proved inadequate. The Independent companies to some extent have followed in the same footpaths, not profiting by the experiences of the Bell Company. The question of protection became so serious that along in the early 90's the Bell Company called a conference of all the leading telephone engineers of the world. At this conference there was adopted a set of rules and specifications which are known as conference specifications, stating what should be necessary for the safe and complete protection of telephone apparatus. The specifications were adopted before any satisfactory protector was known. This led to inventions and patents which were of vast benefit to the telephone properties. These conference specifications are in force to-day and have never been altered or amended. They read as follows:

It must operate with a current of 0.25 of an ampere within one hundred and fifty (150) minutes.

Must operate practically instantly with a current of 2.5 amperes, or more.

Must not be destroyed by ordinary lightning discharges.

Must possess no self-induction.

Must operate equally well on grounded or metallic circuits.

Must prevent abnormal charges of high potential on metallic circuits.

Must not be operated by telephone or generator currents.

Must be so arranged that there can be no possibility of the formation and continuance of an arc.

Must be so arranged that it can be connected quickly and firmly with the line.

Must be made of material which is unaffected by heat or atmospheric conditions.

Must have no loose or double contacts whatever.

Must not be destroyed when operated.

Must protect telephone and transmitter, as well as bells and annunciator.

Must protect office wire, cables and switchboard, as well as other apparatus.

About this same time cables were coming into extensive use for telephone purposes, and it soon became evident that another protection was necessary. One of the Bell forms for this purpose was a small bobbin about an inch long, having a slot in the side in which was laid a fuse wire, and soldered at each end. A bobbin with a fuse of one ampere was used at the outer end of the cable and one-fourth to one-half ampere at the inner end for the protection of the office equipment. About this time the soft fuse made its appearance in the telephone field and was used in all its forms from one-tenth ampere up with more or less success, but nothing that could be depended upon. The sublicensed companies at this time were employing their best talent toward perfecting a system that would protect. In February, 1894, the first official bulletin of the Bell Company was issued to its subcompanies, entitled the "Protection of Telephone Exchange Against Electric Currents of Abnormal Strength." It stated that the protection of wires and switchboards used in telephone central offices, as well as the cables used to bring the wires into central offices, against the destructive effects of currents of electricity stronger than the currents for which they were designed, had been the subject of most careful study for the past few years, and the apparatus developed had been in successful use for more than two years, the best results having been obtained by the use of three distinct pieces of apparatus—an open-space cut-out, a fuse and a device known as a "sneak"-current arrester.

These three devices should be placed in each wire

entering the telephone central office, or the subscriber's station between the apparatus to be protected and the line, the sneak-current arrester being placed nearest the apparatus and the fuse nearest the line. It had been found advantageous to place the fuse at the point where the line is connected with the wire which leads into the central office, or subscriber's station, and to place the open-space cut-out and sneak-current arrester in the telephone central office, or subscriber's station, the wire extending from the fuse to the open-space cut-out being No. 19.

As these three devices are so different in their construction and mode of operation, they may be best considered separately.

The open-space cut-out is intended to operate in case of lightning discharges and crosses with light or power circuits in which the current is distributed at a pressure of over 350 volts. In the case of lightning discharges and momentary crosses with high-pressure light and power circuits, it permits the current to pass to earth without going through the telephone apparatus, while in the case of continued crosses with high-pressure circuits it permanently short-circuits and grounds the line.

The requirements, therefore, for this arrester are that it shall not be operated by such currents as are employed in telephony, but shall respond to currents at higher pressures. The perfected device, known as the carbon plate arrester, consists of two rectangular blocks of carbon having two flat surfaces, between which a definite separation is maintained by means of a U-shaped mica or silk separator. The sensitiveness of this device depends upon the separation. If the separation is too small, which will be the case when the mica or silk washer is too thin, the ringing or telephone currents will operate the arrester and will be shunted between the plates; if the mica or silk washer is too thick, the sensitiveness will be reduced and the arrester will not protect against crosses with light or power circuits, though it may still remain operative in the case of lightning discharges. The proper thickness of this mica separator has been determined by a series of elaborate experiments from which it was found that a thickness of .0055 of an inch will be sufficiently small to cause the protector to operate for a difference of potential of 350 volts between the plates. Carbon is chosen as the material for the surfaces between which the discharge shall take place, for the reason that the separation between the plates may be much greater for the same voltage of discharge than if metallic plates were used, and also for the reason that metallic plates are liable to be welded together by comparatively brief discharges. The greater separation which may be used with carbon plates is due partly to the inherent roughness of the carbon surfaces and partly to the carbon dust which is always present. This carbon dust will be found a frequent source of annoyance to the inspectors, as it is apt to collect between the plates, tending to short-circuit them. This difficulty has been reduced to a minimum, however, by the use of a silk separator and by making the mica separators in the shape of a U; it is best to arrange the protector with the open portion of the mica separator directed downward, in order that the dust may not collect between the plates. As the chief function of the protector is lost when a thicker separator is used than that specified above, the practice of using two separators in place of one, to avoid the necessity of inspection to remove dust, is to be most strongly condemned.

In case of a low-resistance cross with a high-pressure light or power circuit, as soon as the arc occurs between the plates of the arrester, the current to ground which results is sufficient to blow out the fuse and open the circuit, thus extinguishing the arc; but when a high-resistance cross occurs with high-pressure mains, the current which results, though sufficient to maintain an arc in the carbon plate arrester, may not be sufficient to blow the fuse. In order that, in such cases, the arcs may not be maintained and the carbon blocks become unduly heated, the carbons are made with a slight cavity in the sparking surface, in which cavity is placed a small globule of alloy. When an arc is maintained an appreciable time, the carbon blocks become slightly heated, the globules flowing between the plates extinguish the arc and so reduce the resistance of the arrester that but a negligible amount of heat is generated in it by the current, which may then continue to flow without danger to the arrester or to the telephone system. The arrester is so mounted that one of the carbon plates is normally in contact with a good ground, the two plates and the mica or silk separator being firmly held in place by a German silver spring bearing on the other plate, to which spring both the incoming wire and the sneak-current arrester are connected.

The fuse is intended to protect against continued low-resistance crosses with high-pressure mains, and it is not intended that it shall operate for lightning discharges and high-resistance crosses with high-pressure lightning or power circuits. It is impracticable, however, to use a fuse which would not be operated by severe lightning discharges, as it would necessarily lack sufficient sensitiveness to be operated by currents due to crosses with high-pressure circuits. The fuse is intended as a protection for the wiring, and the requirements for this device are that it shall operate to open the circuit for all currents capable of overheating any of the leading-in wire between it and the open-space cut-out and sneak-current arrester. In some cities it has been the practice to use for this purpose ordinary fuse wires placed between terminals about three or four inches apart; but this has proven unsatisfactory, as often, in cases of crosses with high-pressure mains, such a fuse will fail to protect, owing to the establishment of an arc between its own terminals or the terminals of the adjacent fuses.

To overcome this defect and to meet the requirements of central-office protection, a form of fuse protector has been designed. This protector consists of a ribbon-shaped fuse wire inclosed in a tube of small bore, which tube is sealed, so arranged as to clamp upon the terminal wire, whereas the other end is provided with means of clamping it to a German silver spring to which the cable wire is connected. Such a protector can be mounted on the iron cable head used as a terminal for the lead-covered cables, or may be mounted on a frame to which the wires from a flexible terminal are directly fanned.

The object of the sneak-current arrester is to protect against currents at pressures insufficient to operate the open-space cut-out and fuse, but great enough to be dangerous to the switchboard and other central-office apparatus. This arrester operates to permanently ground or open the line in case of the continuance of a current sufficient to abnormally heat the apparatus which it is designed to protect.

A gerat number of these protecting devices have been investigated, and the most reliable in its operation has been found to be one in which the heat generated by the passage of the current through a coil of German silver wire melts a fusible alloy, thereby relasing a strong spring which grounds the line.

The sneak-current arrester at the exchange should be placed as near as possible to the carbon plate arrester and be connected in the line between it and the switchboard. The arrester designed for exchange purposes consists of a coil of German silver wire on a conducting shell surrounding a metallic pin, to which it is soldered with a low melting alloy. The whole is mounted in a hard rubber case, and held upon a fork between a strong German silver spring and a ground plate. When the coil

becomes heated, the fusible metal melts, the spring forces the pin through the shell, thereby grounding the line.

In order that the apparatus to be protected may not be subjected to danger while the heating coil is removed for inspection, repairs, or other purposes, a hard rubber stop is mounted on the fork so as to maintain the fork and spring separated, and so open the circuit at this point when the heating coil is not in place.

This arrester is not necessarily destroyed, nor its resistance altered, by being operated; and on restoring it, its success depends upon the nature of the alloy and the skill with which the shell is soldered to the pin, the same low-melting alloy should be employed as was used in the manufacture of the protector.

In September, 1895, the insurance companies, through the National Board of Fire Underwriters, took an unusually active interest in the question of protection, there having been reported so far 815 electrical fires, 113 of which were due primarily to crosses between telephone wires and electric light or power wires. These represented a property loss of over $500,000. In a bulletin issued that year they state that a satisfactory protection for telephones should fulfill the following requirements:

1st. It should cut off or divert to a harmless path any current with a potential over 350 volts.

2d. It should open the circuit instantly and in such a way that it will not automatically close again, whenever there is sufficient current to heat to a dangerous point the finest wire in the signaling circuit, and to do this on some circuits it must respond to not over four-tenths of an ampere.

3d. It must perform both the functions alluded to above, in such a way that no considerable flash will be produced, and no particles of heated material will be thrown against or upon any combustible substance which may be near it.

In this bulletin they describe and set forth practically the apparatus as described in the Bell Telephone Company's previous bulletin which they endorse and recommend for use.

I have cited herein the three most eminent authorities upon the subject of protection, all of which show the absolute necessity of the employment of a heat coil for the detention of and protection against sneak-currents. A fuse as a detector of, or protector against, sneak-currents is practically worthless, for the fuse wire will heat to a glow, allowing a continual flow of enough current to heat and burn the delicate apparatus employed in telephone work. Practice has demonstrated that it is not the lightning discharges nor the high-tension currents that are the greater menace to telephone properties, but it is the low-tension sneak-current. The majority of damage to telephone properties caused by contact with foreign wires is traceable to sneak-currents. Thus the importance of the use of a heat coil cannot be overestimated where properties are exposed to this danger.

There has been much discussion upon this subject of proper protection between the different operators in the Independent field, a great many of whom use a fuse wire of various sizes as their only protection for properties valued from $1,000 to $100,000 each. Now, it is a known fact that a fuse wire in itself is not a protection against either lightning or high-tension currents. It is true at times it is operated by both currents, but the unreliability of a fuse lies in the fact that it cannot be tested, for when it is tested to its full carrying capacity it is destroyed, hence the carrying capacity is estimated by the gauge of the fuse. A fuse in connection with a pair of carbons, which surfaces are separated by mica or silk .0005 inches thick, makes a positive form of protection against lightning and a fair protection against strong currents, but an unreliable one against sneak-currents. For toll work, carbon plates are preferable with large facing surfaces, give good and ample protection at the station against lightning. The only complete protection is that hereinbefore described and endorsed by the Board of Fire Underwriters and consists of some form of a heat coil for sneak-currents, the especially arranged carbons for strong currents and lightning, and a fuse; the fuse generally being located at the outer end of the cable as a protection for the same. The all-vital point with all forms of protection is the use of a good ground of a large capacity.

There is one point with reference to proper protection that probably only a few of the operatives have considered, and that is the legal liability when fires or loss of life emanate from the crossing of a telephone wire with wires of a high potential. It is often the case that fires are started in residences and places of business from the crossing of telephone wires with light or power wires, the damage as a rule being trivial, but at times the entire residence or building has been destroyed. There can be no question as to the responsibility for loss in such cases. They are bound to furnish the available means of protection to avoid liability in cases of such loss. Thus, this is a substantial reason why telephone properties should be protected.

As the Independent telephone companies realize the necessity of using apparatus of the best grade to give efficient service to their patrons, they also realize the necessity of protecting their investment, also the life and property of their patrons. Consequently, with the advent of the new century you will find that this ever and rapidly growing industry is insisting upon a thorough protection, as well as practical apparatus, and these demands have spurred the manufacturers to such an extent that they are to-day offering Independent telephone companies the same protection that has the endorsement of the National Board of Fire Underwriters of the United States.

ANSWERS TO QUESTIONS.

The following letter is received from F. G. D.:

"Please explain why, with fifteen 1,000-ohm ringers bridged across a line, I find little or no short-circuiting effect to the talking current, while a magneto will scarcely ring them all on account of the load."

This is a frequently asked question. Owing to the ringer coils having iron cores the coils present what is called impedance to alternating current. When a current is passed through a coil surrounding an iron core, the core becomes magnetized and tends to induce in the winding a current in an opposite direction causing a choking effect. If the current applied is direct it soon comes up to the maximum permitted by the ohmic resistance; but if alternating or interrupted current is applied this impedance chokes it back. The faster the period the greater is the retarding effect. This accounts for the fact that there is such a heavy drain on the ringing current while there is little or none in the talking current. The magneto gives upward of fifteen alternations per second, while voice vibrations are frequently as high as five hundred per second. Not counting the line resistance you have something like 66 ohms across the line. The equivalent resistance to voice currents is probably nearer to 20,000 ohms. This impedance depends most largely on the number of turns of wire, and the size and quality of the iron core. There would still be a considerable impedance even though the core was removed. It is an actual fact that a long-distance line will transmit better with impedances bridged across at intervals, as it relieves the evil due to a high electrostatic capacity.

M. H. T. asks whether dry batteries give as good service as the ordinary Le Clanche type of battery.

This is a difficult question to answer definitely, as there are both good and poor batteries of both kinds. Several years ago there was not a dry battery on the market worth the bother, but at present there are several makes of dry cells that stand right up to the best grade of wet cells. Used for the same purpose as wet cells they give equally good service. We would suggest, in order to compare their merits, that you get several of the different kinds, and by discharging them through resistances see which holds out the longest. Do not discharge them too fast, as it is not a fair test. Use a 10-ohm coil and discharge for fifteen minutes, and give them fifteen minutes' rest. You had better arrange to do it automatically with a clock, for it will take several months to exhaust a good cell. The cell which holds up the best will be the one to take, if the price is all right.

A. B. T. writes:

"I have a metallic circuit toll line, running two ways from this exchange, the drop and jack being bridged across the line. At present, when anyone is using the line, all the rest of it is out of use. I desire, when the line running one way from the exchange is in use, that I can use the other end without interference. I also wish to have it arranged so that parties can ring through."

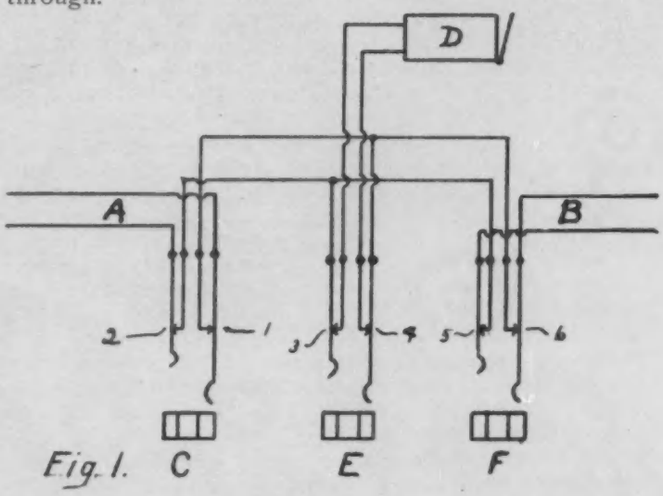


Fig. 1.

The figure below (Fig. 1) will explain how this may be done. C, E and F represent jacks at the switchboard. D is the drop, and A and B are the two branches of the line running each way. If a connection is made with A by plugging into C, the contact points 1 and 2 are opened, cutting off the branch B. It will be seen, however, that the drop D still remains on B, ready to receive a signal from that end of the line. If then a call comes in on B it is answered by plugging in on jack F. This act will open the contacts 5 and 6, and cut off the connections to the other jack C and also drop D. It will thus be seen that we have two independent lines. It will also be seen that a signal can be sent by the board throwing signals on each side. Jack E is placed across the line so that the operator can plug in to listen without interrupting parties who may be talking through. When plugging in E the drop is cut off at the points 3 and 4. If it is not desirable to have E on the circuit the drop may be permanently bridged across the line between jacks C and F.

"Why is not the Blake transmitter as good as those using granular carbon."—W. H. M.

In one respect the Blake transmitter is superior to any other in use, and that is because of its very good articulation. It is not so strong a speaking instrument and it requires a great deal more attention to keep it in order than a granular carbon transmitter, consequently the latter has superseded it in Independent telephone companies. The Blake transmitter cannot stand more than one cel of sal ammoniac battery without frying. Neither can a person talk very loud into it without making it rattle.

"Is there anything which you can suggest that will prevent the plugs and jacks of a switchboard from wearing rapidly?"—J. H. L.

Your plugs and jacks may be made from inferior metal. However, the plugs and jacks may have their life prolonged very greatly if the plugs are lubricated slightly. Cover the plugs with a very thin coating of vaseline. There should not be enough to see; in fact, not enough to make a grease spot on a clean piece of cloth. The vaseline can be applied by a cloth having a little vaseline soaked into it. If you put on too much, the jacks will become fouled up. Lubricate the plugs each morning and you will find the life of the apparatus will be prolonged fully 100 per cent. This has been determined by actual experiment.

"Would you call an average of twelve calls a day per line very busy for an exchange of 600 subscribers? How many subscribers should each operator handle."—G. H. H.

It is not as high as a great many other exchanges. I should call it a fair average. Each operator should be able to handle 100 lines if there are no more calls per

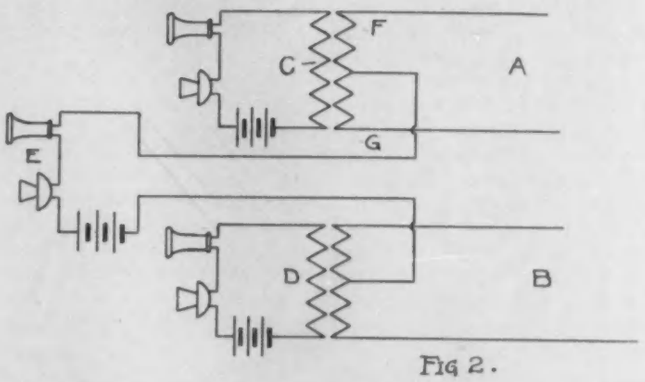


Fig 2.

subscriber than the above. Where there is a complete supervisory system to the cord circuits and self-restoring signals each operator might take care of 150 subscribers.

R. A. D. sends the circuit shown in Fig. 2, which will be recognized as a duplex telephone circuit. C and D are repeating coils. A is a copper metallic circuit and B is an iron circuit. Telephone set E is cut into the middle of the repeating coils C and D and has A circuit for one side and B circuit for the other side of its line. It was found that owing to the unequal resistance of A and B, the E instrument was very noisy. The other instruments were, of course, quiet. Now by cutting into the circuit A a resistance equal to the difference between the two circuits, both sides will become of the same resistance, and under certain conditions the line will become quiet. If the wire is of the same gauge as the resistances are, cut in at F and G at one end and at a similar position at the other end of the copper line, the wire should be quiet. If, however, the iron and copper wires are of different sizes they will have different capacities to earth, and consequently the circuit will remain unbalanced.

Telephone franchises were sold at auction in St. Petersburg, Russia, on November 21st. The new régimé begins in November, 1901. The government has prescribed the conditions of rentals, and the franchises were given to the bidders fixing the lowest rates to subscribers. The St. Petersburg municipality won in that city, agreeing to demand 45 rubles ($34.65) annually, compared with 250 rubles ($192.50) hitherto charged.

ILLUSTRATED COURSE IN TELEPHONY.

CONDUCTED BY W. A. TAYLOR.

SWITCHBOARD AND CENTRAL OFFICE WORK.

In connection with the subject of cross-talk in the January issue reference should be made to the case where grounded circuits are in use and more than one telephone is connected to a single ground rod or plate. If the ground is in any way poor the return line of one line will be those of the other telephones, as is shown in Fig. 7. Here there are three telephones, A, B and C on one ground, G. When any one of the instruments signal central, if the ground is good current will pass over the line, past the jack and through the drop to the ground G1, and and thence back to the telephone, the resistance of the ground being so low that little or no current is shunted back over the other lines through the other drops. Now suppose G was open or of high resistance. If subscriber at C were to ring the current would pass out over line L_3, past jack J, through drop F, also through drops E and D, past jacks I and H, over the lines L_1 and L_2, through the

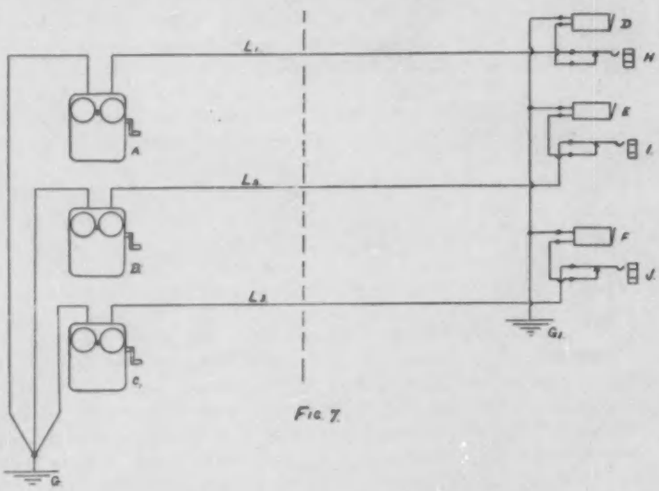


Fig. 7.

bells of A and B and back to C. Drops D and E would fall as well as F, while the bells of all three instruments would ring. It does not necessarily follow that if the ground rod is in damp ground that the ground is good, though, generally speaking, that is the case; on the other hand, sometimes in dry ground a very good ground may be obtained. It is always best to make a ground connection on water or gas pipe if possible, connecting the wire as near as possible to the point where the pipe enters the earth. If there is no piping and it is not possible to obtain a ground with a rod, dig down till damp earth is obtained and then, connecting the ground wire to a copper plate a square foot or more in area, place it in the bottom of the hole, cover the plate with coke to a depth of several inches and fill the hole with earth. It sometimes happens that a good ground can be obtained in a well. If the well has a metal casing all that is necessary is to solder to the casing. If an open well, drop a copper plate with the wire fastened securely to it, to the bottom of the well. A good surface should be provided, for if the water is pure and clean there is considerable resistance presented. Earth that is always moist usually presents less resistance than water. Contrary to the popularly accepted idea, water is a liquid of high resistance when pure, though when mixed with the various salts which are in the earth, its resistance is very much lowered.

On common return systems, where the leads are very long, the return wire must of necessity have considerable resistance and throw more or less cross-talk to the other lines of the lead. This trouble can be remedied to a considerable extent by putting high-wound secondary windings to the induction coils of the telephones, these coils will present a higher impedance to the current from the other lines, choking it back. It will not be good practice to wind the coils higher than 250 ohms. Strong speaking transmitters should not be used, as the volume of current is so great as to make cross-talk, when otherwise there would not be trouble.

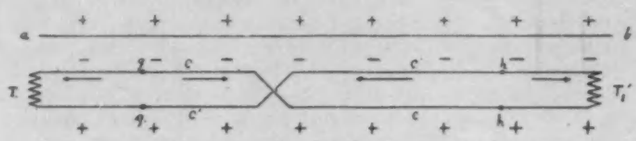


Fig. 8.

On long aerial leads of but one circuit, if there are no outside disturbances, there need be no transpositions. All lines with two circuits or more, and lines paralleling lighting or telegraph circuits, should be transposed, both with respect to each other and to the outside disturbances. On a long line but one transposition to prevent induction from a parallel line will not be sufficient. So far as electromagnetic induction is concerned, one transposition would be enough, but in the case of static induction, which is the greater, we have the following conditions: In Fig. 8 let ab be a disturbing line and c'c a parallel circuit, with the transposition in the middle. When ab receives a positive charge the negative charge is induced into a nearer portion of the telephone circuit and a positive charge repelled to the farther side. In this distribution of the charge on the telephone circuit a current is set up, the positive charge flowing each way on the near side of the line one way around through the telephone T and T', and the other way across the transposition. Thus it is seen, while the change in the charge is taking place a noise will be heard in each telephone. Now it will be evident that there must be two neutral points, gg and hh, from which the current flows

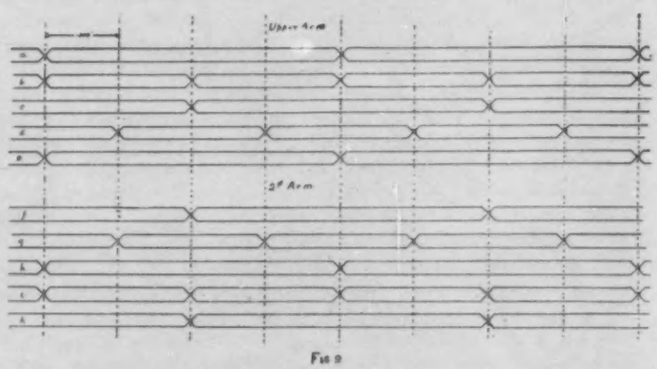


Fig. 9.

in opposite directions. Should the telephones be placed at these points there would be no disturbance perceptible, and the farther the telephones are removed from these neutral points the more will be the inductive effect. Now, as these neutral points are hard to find, and if found the chances are that they will be in an inconvenient place, it is the custom to place the transpositions from a fourth to a half a mile apart. By so doing the telephone may be placed anywhere along the line and still be near enough to a neutral point to give entire immunity from disturbing effects.

Fig. 9 shows the method of transposition used by the American Telephone and Telegraph Company on all their

leads. This system gives perfect satisfaction. The figure shows the method of transposition for ten-pin cross-arm, that is, five circuits, a, b, c, d and e, on the top arm, and five circuits, f, g, h, i and k, on the second arm. Circuits a and e are transposed on the same pole every mile. Circuit b starts with a transposition on the same pole with a and is transposed every half mile. Circuit c is transposed every mile, but on poles half way between the transpositions of a. Circuit d has its first transposition a quarter of a mile from that of a, and then one every half mile. On the second arm the transpositions of the circuits come just half way between those of the respective circuits above. The third arm is like the first, and the fourth like the second, and so on, the odd arms being all alike and the even arms also transposed alike. Where eight-pin arms are used either the right-hand or left-hand circuits may be omitted, the rest being transposed in exactly the same manner as with the ten-pin arms. With six-pin arms both the right and left circuits are omitted. Where lines are strung, but the arm not filled, say when but one circuit is being strung, with the idea of putting in more in the future, it is well to put in all the transpositions for that circuit.

If a metallic circuit power or light line parallels common return or grounded lines, immunity from induction disturbances on the grounded lines may be obtained by transposing the power or light circuit. The circuit should be transposed every third or fourth pole for the whole distance which it parallels. It should, of course, be understood that the transpositions will have very little or no effect unless both the telephone and lighting wires are well insulated. No transposition has yet been invented which will prevent disturbances from leakage.

Where there are a number of grounded lines on a lead transpositions have been tried by changing the posi-

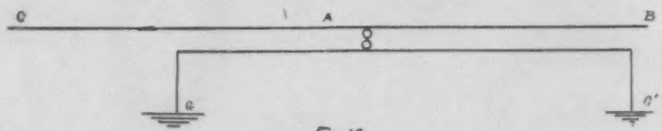


Fig. 10.

tions of each wire with respect to the others; while this may help some, it will not do away with cross-talk or induction from parallel leads entirely. The only thing it does is to increase the average distance from a disturbing line which may originally have run near it. At the same time it decreases the distance of other lines on the same lead.

Where there are metallic circuits and grounded circuits on the same lead place the grounded ones as far apart as possible. They will not be disturbed by the metallic circuits for the same reason that the transposed metallic circuits are not disturbed by the grounded circuits. The wires between the grounded lines have a shielding effect, and consequently tend to prevent cross-talk between the grounded ones.

In grounded toll lines coming into a district where there are a number of trolley lines, the noise due to the leakage into the toll lines is so great as to make them almost unusable. There are two ways of getting rid of this trouble. One way is to string the line as a complete metallic circuit to a point a mile outside of the trolley district, then ground one side and connect the other to the toll line, as in the diagram Fig. 10. C A represents the grounded toll line, A B is the portion of the line within the trolley district, strung as a complete metallic circuit with both ends of one side grounded at the points G G'. In the other method, which is better because the portion A B remains balanced, the repeating coil at A and B is used. Fig. 11, R and R' represent the repeating coil, the line C passes through one side of each coil and is grounded at G and G'. The metallic circuit portion A B passes through the other windings of the coils, but is not grounded. It should be understood that if the line is to end within the trolley district but one repeating coil is necessary, that one being placed a mile or more without the trolley district.

A repeating coil used for this purpose should be of the very best design, with each half wound with the same number of turns and of about the same resistance. The coil should be designed to be efficient for talking and also for ringing. It is not necessary for it to be of high resistance or to have an immense number of turns. The core should be made up of a large number of fine soft iron wires and should be of the closed field type; for high efficiency in ringing there should be a large amount of iron in the field. It will be seen that this repeating coil is

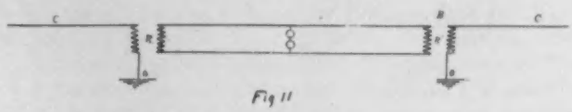


Fig. 11

more expensive than the average on account of the amount of iron in the field. However, when there is no necessity for ringing over long lines a cheaper coil can be used, and one that will talk just as well.

Cable Repair.—In locating and repairing trouble the average exchange is at a great disadvantage, owing to lack of instruments and experienced cable men. The most frequent trouble arises from grounds and short circuits due to moisture and from open conductors. However, when there are open wires it is generally due to some disruptive discharge of lightning, high tension current, or to bad splicing, which shows up some time after the cable has been installed and accepted. In the case of open circuits due to disruptive discharges, it is generally found that the sheathing is also punctured, which permits moisture to enter, and thus grounds the cable. A puncture in the sheathing may be found by going over the cable very carefully. In order to make the work of inspection easier, a seat suspended from grooved wheels may be used. These wheels roll along the top of the messenger wire and are readily propelled either by attaching a hand line and having a second party pull it along from pole to pole, or the inspector may pull himself along by means of the messenger wire. No care should be spared in the examination, as a very small pin hole may be the source of the trouble. In case of open circuits there are not generally enough wires open to make it worth the while to rectify the trouble, as they can only be located by the aid of experienced workmen and expensive instruments.

In case of moisture getting into the cables, proceed as follows: Erect a platform on the messenger wire, suspending it at such a distance below the cable as to make the work convenient. Have an ordinary plumber's blow pot, and in a seamless sheet iron or tin kettle heat about seven or eight pounds of paraffine to a temperature considerably over the boiling point of water. The heat should be such that if a piece of moistened paper be dipped into the liquid it will bubble up very energetically. It is well to provide a tight metal cover for the paraffine kettle to be used to smother the flames in case the paraffine catches fire. Now remove the lead sheathing from the cable for about a foot each way from the hole and proceed to pour the hot paraffine through the core of the cable by means of a dipper holding about a pint or more, catching the paraffine in the kettle again as it runs through, being sure to keep the paraffine hot all the time. Keep pouring the liquid through the cable till bubbles no longer appear. Now cut back about six inches more of the sheathing and treat the newly exposed core the same way. Continue boiling out and cutting back the sheathing till a portion of the cable is reached where there is no more moisture apparent. In starting to pour the paraffine through the cable

always commence next to the sheathing and work toward the center of the exposed portion, so as to drive the moisture away from the sheathing, otherwise the heat will drive the moisture before it inside of the sheathing, thus making the work longer and calling for a longer sleeve on the cable. When the cable is thoroughly dry a piece of lead pipe large enough to pass over the sheathing should be provided and about four inches longer than the uncovered space. Split the pipe along its whole length and carefully separate the edges far enough to permit slipping on to the cable. Now close it about the cable, allowing it to project two inches over the sheathing at each end. With a scraper scrape a V-shaped groove along the seam and then with tallow for a flux solder up the seam, being careful to allow no pin holes. Now with a wooden mallet turn down the ends of the sleeve till they fit close to the sheathing and make a wipe joint at each end. It should be cautioned that no acid, salts or resin should ever be used in soldering the sheathing. The acid and salts would get into the cable and cause trouble, and where a flux of resin is used sufficient heat cannot be brought to bear to burn it out, therefore it would be left in the cracks and seams, sooner or later to break away and leave holes. It should be observed that too great caution cannot be taken in repairing cable. If possible to prevent do not open a cable in damp or wet weather. If the cable must be opened in bad weather rig up a tarpaulin to cover the work. Try and arrange the work so that it may be finished the same day on which it was started, working continuously till the job is completed.

In case the moisture in the cable has penetrated a greater distance than will permit a sleeve being put on, the defective part should be cut out and a new piece spliced in. It is hard to make a good job of putting on a sleeve of more than six or eight feet in length. In cutting in the new piece it will save a great deal of trouble in changing the cable conductors in the terminal boxes, if the piece is first tested out and the ends marked; then cut out the wires from the cable, one by one, and splice to the conductors of the new piece as fast as the wires are cut.

When the cables are to be spliced proceed as follows: Cut back the sheathing from each end about twenty inches, then wrap candle wicking tightly about the core next to the end of the sheathing, so that paraffine or moisture cannot readily penetrate under the sheathing. Now dip the exposed ends of the core into hot paraffine. This is done so that the paper covering will not untwist, or, if the core is saturated with compound, the wires will be made less sticky.

In either case the insulation will not absorb so much moisture from the hands. Fasten the cables securely, with the ends of the sheathing twenty inches apart, having first slipped a lead sleeve twenty-four inches long and inside diameter about three-quarters inch larger than the outside of the cable, over the cable. Untwist the cable (not the pairs) and turn the wires back over the sheathing. Make the splices in the first pair about two inches from the end of the sheathing, being sure to connect like colors together, and also to pull the wires taut. After cutting the wires so as to lap about an inch slip a paper sleeve three inches long by a quarter of an inch in diameter over one of them, and remove three-quarters inch of the insulation from each end and twist the ends tightly together, including a quarter inch of the insulation in the twist. Fig. 12 shows about how the splice should look. The insulation is twisted in so as to keep it from slipping back. After the twist is made it is bent lengthwise along the wire and the paper sleeve slipped over the joint.

This splice is better than the ordinary running splice, as it is more easily made and makes a tighter joint. The running splice is very apt to work loose in handling.

It is not necessary to solder the joints, as they are kept dry and no corrosion can take place. After the first splice is made the next pair is spliced about two inches farther away from the end, and thus each one is made, scattering the joints uniformly along the splice until all are joined. When finished, each pair should be tight. The next step is to pour hot paraffine through the splice until there is no possible chance of moisture remaining. Wrap the splice with cotton cloth and treat with paraffine again. Now heat the lead sleeve until it is quite hot, so as to expel any moisture from it and slip over the splice; beat down the ends of the sleeve close to the cable and wipe a joint on each end. Especial care should be taken in making the wipe joint, for if the slightest pin hole occurs it will cause trouble sooner or later. Be careful not to nick the wires in removing the insulation, as they may break and open the circuit. Always splice one pair at a time, keeping the rest of the wires out of the way to avoid mixing the pairs. When cables are run underground there are nearly the same conditions to be met as in the aerial cable. There is apt to be more or less moisture accumulated in the conduits, and when there are adjacent grounded power or lighting circuits the evil of electrolysis

FIG. 12.

is apt to arise. The tendency of a grounded current is to take the path of the least resistance back to the generator, and if it happens that this path is along the cable sheathing it will go by that way to some point where it can take a better conductor. At this point, if there happens to be moisture surrounding the cable and if the moisture is an electrolyte the sheathing will be corroded and some time the cable insulation will be broken down. In all underground cables there are danger points which would be subject to electrolysis if moisture was present to form an electrical path to lead the current away from the cable. In order to find the danger points test between the cable sheathing and near-by rails, water or gas pipes, with a voltmeter, connecting the positive terminal to the sheathing. If there is no deflection there is, of course, no danger. If there is a backward deflection it will show that the current is passing into the cable at that point. If the voltmeter needle is deflected in the right direction it will show that there is a tendency for the current to flow away from the cable and consequently a point of probable electrolysis. Having found the danger point, test at other points each side of this place till a point is reached that shows the greatest deflection of the voltmeter. From this point run a copper wire to the gas pipe, water pipe or rail, as the case may be, soldering it to the cable sheathing. The best way to fasten to the rail is to clamp the wire under a nut. For water pipe fasten the bond wire by means of a heavy iron clamp, passing it around the pipe. This bond wire affords a much lower resistance than the earth, and a metallic path from the cable, consequently all the current will pass through this wire. In working about manholes be careful not to step on the cables or subject them to any rough usage, for as the sheathing is quite soft they are easily punctured. Always see that the manhole covers and handhole covers are kept tightly closed.

"WELL-KNOWN HEADS OF WELL-KNOWN HOUSES."

A BIOGRAPHICAL SKETCH OF FRANK G. JONES.

Mr. Frank G. Jones, president of the American Electric Fuse Company, whose portrait illustrates this sketch, is a descendant of an old English family. He was born in Chicago, August 19, 1874, and attended the public schools of his native town, after which he entered Ann Arbor, graduating in 1893, with the degrees of LL.B. and LL.M. After leaving college Mr. Jones practiced law in Chicago for four years, giving up his practice to take the position of secretary and treasurer of the American Electric Fuse Company. In the spring of 1900 he succeeded to the presidency of the company, and its success is due in no small measure to his business acumen and untiring efforts. Under his management the business has quadrupled and now extends into every state and territory in the Union, as well as nine foreign countries. Offices have been opened in New York, Chicago and San Francisco, and it is the intention to establish branch agencies abroad.

FRANK G. JONES.

While a comparatively young man, Mr. Jones is one of the successful manufacturers in the Western metropolis, and enjoys the confidence of all with whom he comes in contact. As an example of the young man in business his success is a matter of sincere congratulation.

MEETING OF MICHIGAN TELEPHONE ASSOCIATION.

The annual meeting of Independent Telephone Association of Michigan was held at the courthouse in Lansing on February 6, 1901.

The meeting was called to order at 10 a. m. by Mr. J. B. Ware, president, with the following gentlemen present:

J. B. Ware, W. J. Stewart, Citizens' Telephone Company, Grand Rapids; R. F. Johnson, Saginaw; F. M. Howard, Flint, Valley Telephone Company; Geo. S. Aldrich, St. Louis; C. O. Trask, Alma; C. F. Brown, Alma, Union Telephone Company; C. W. Gale, S. E. Parkhill, R. W. Crawford, Owosso Telephone Company, Owosso; Frank B. Johnson, Citizens' Telephone Company, Lansing; A. J. Little, Rev. Mr. McCoy, M. Lenchen, Calhoun County Telephone Company, Battle Creek; Wm. Robinson, Citizens' Telephone Company, Muskegon; J. H. Fildew, National Telephone Company, St. Johns; W. C. Osborne, Jacob Upright, Eaton County Telephone Company, Charlotte; J. H. Tripp, Kibbe Telephone Company, Kibbe; —— Palmer, Sunfield Telephone Company, Sunfield; W. B. Service, Greenville Telephone Company, Greenville, and others.

On motion of R. F. Johnson of Saginaw, a committee of three was appointed by the meeting, to attend to the printing and circulating of the minutes of this meeting, especially the president's address.

Said committee as appointed consisted of Mr. Johnson, President Ware and Secretary Brown.

Upon motion, the meeting proceeded with election of officers for the ensuing year.

Mr. Robinson moved that a committee of three upon nominations be appointed by the chair.

The chair appointed Wm. Robinson, R. F. Johnson and J. H. Fildew as such committee.

The committee, after consultation, made the nominations which, upon motion, was unanimously ratified by the meeting, viz.:

J. B. Ware, president, Grand Rapids; Orrin Morrow, vice-president, Benton Harbor; C. F. Brown, secretary, Alma; J. H. Fildew, treasurer, St. Johns.

Executive Committee: J. B. Ware, Grand Rapids; Orrin Morrow, Benton Harbor; C. F. Brown, Alma; J. H. Fildew, St. Johns; J. F. Hyde, Hart; W. O. Hunt, Adrian; C. W. Gale, Owosso; R. F. Johnson, Saginaw.

Mr. C. F. Brown of Alma, secretary of the Union Telephone Company, in behalf of that company, invited the association to hold a midsummer meeting at Alma in August next.

Upon motion, the matter of holding a midsummer meeting and question of place of holding said meeting was referred to the executive committee.

After considerable discussion it was moved and adopted "that all matters of importance arising during the interim between meetings of the association be referred to the executive committee, with full authority to act."

A general discussion of the affairs of the association and of its members was engaged in, and a very valuable interchange of views had.

Upon motion, the executive committee was directed to prepare new by-laws, for submission to next meeting of association.

Adjournment.

The annual meeting of the Maui Telephone Company was held at the Paia Postoffice, Honolulu, on January 15, and the following officers were re-elected: H. P. Baldwin, president; D. C. Lindsay, vice-president; E. B. Carley, treasurer, and W. O. Aiken, assistant treasurer and auditor. It was voted to raise the capital stock of the company from $17,500 to the limit, $25,000, for the purpose of paying off the old debt of about $6,000.

To accomplish this 500 additional shares will be issued, 400 of which will be offered to stockholders at $15 ($10 being par value). The $6,000 thus to be realized will be used to pay off the debt. The remaining 100 shares will be held in the treasury to be sold only in case of necessity.

Telephony.

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CHICAGO, MARCH, 1901.

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CONSOLIDATIONS.

The statement has been made that in the course of a few years the entire telephone business of the United States will be controlled by one gigantic company with a billion dollar capital. Just how this result is to be brought about is not made clear, but the tendency of the times toward combinations is cited to show that the telephone industry must of a necessity come under the control of a few men who will make it as great a monopoly as is the oil or steel industry. We do not believe this is a possibility. As a matter of principle, the people of this country are opposed to monopolies and we think those who use the telephone would revolt against any attempt to again monopolize it. Just how long the people will stand for trusts and monopolies in general we do not presume to know, but we believe we are safe in assuming that the telephone business of this country will never pass into the hands of a few to be a detriment to the many. Independent companies have made the telephone a necessity, consolidation would make it a luxury.

THE BERLINER DECISION.

On February 27 the Berliner patent was declared invalid by Judge Arthur L. Brown in the United States Circuit Court at Boston. The court ordered dismissed the two suits in equity by the American Bell Telephone Company against the Century Telephone Company and the National Telephone Company, all of Boston. These suits were begun several years ago and asked for injunctions restraining the defendants from using carbon transmitters, and are distinct and separate from the "government suits" on the Berliner patent, which were tried in the same United States Circuit Court district. The suits decided by Judge Brown were strictly on their merits and the sweeping decision declaring the patent invalid for not only one, but for several reasons, is a victory for the Independent telephone public of far-reaching effect. The court leaves but little for the Bell monopoly to hope from this patent, which has had an odor of fraud about it from the beginning. It may be confidently expected that it is now a "dead issue" and that the Bell company must seek some other form of intimidation. This patent has been useful to the Bell company in preventing capital from engaging in opposition to its business. Many Independent telephone systems will now be enabled to float bonds or stocks, which heretofore would not have been possible, by reason of the fear among capitalists of this bug-bear patent. It is of the greatest importance to Independent telephone interests that this Berliner patent has been so thoroughly and clearly disposed of. It also shows what slender hold the Bell company had to the "national monopoly" it claimed. The court's decision is profuse with comments tending to indicate that the Berliner patents record teemed with fraud. The Berliner patent has been a source of mischief for many years, but the decision of Judge Brown leaves little to be expected from it in the future. The Associated Press dispatch and newspaper statements have intimated that the Bell company would appeal this case to the United States Supreme Court. This news was not surprising, as it came from the home of the Bell monopoly, but like other reports on this patent, was not truthful. There is nothing in the suit decided upon which to base an appeal to the United States Supreme Court, and it is not even likely that any effort to carry the case to that court will be attempted.

Emile Berliner, who afterward sold his rights to the Bell Company, applied for a patent on June 4, 1877, but not until November, 1891, a few years before the expiration of the original Bell patent, was it granted to him. This patent was the one in suit, and it was claimed to cover the field of an art, method, process or principle of a speech transmitter, particularly of the creation of electric waves, by varying pressure between bits of carbon already in contact. It yet has eight years to run, its limitation expiring in November, 1908.

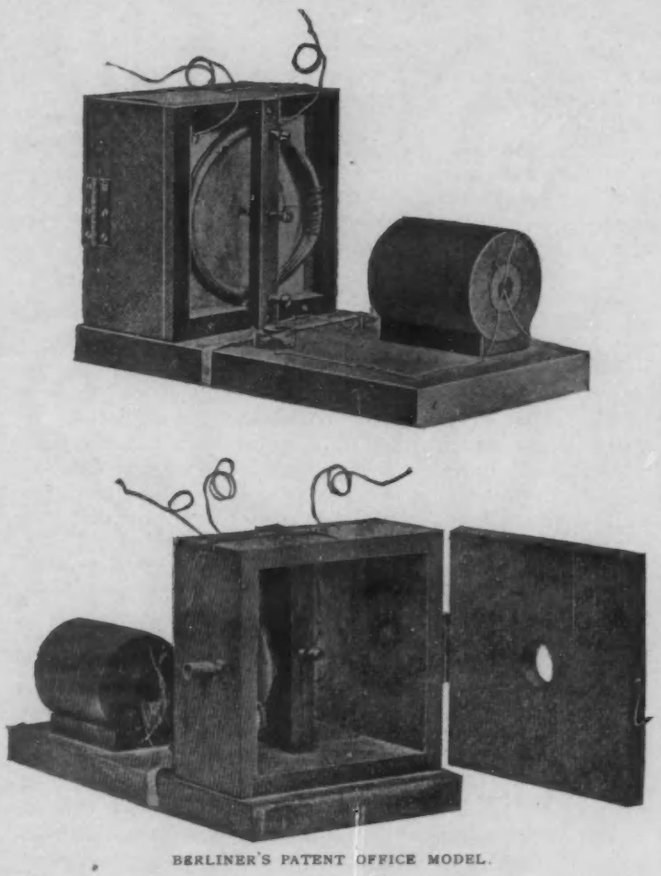
But the court decides it is invalid because the invention described in the patent is radically different from the invention described in the application; because the invention was previously patented by Berliner, who took out a speech transmitter patent in 1880; because Edison was the prior inventor, having filed his application for transmitter on April 20, 1877, and because Berliner had not invented and did not apply for a patent for a constant contact transmitter. Again, because some of the claims, 1 and 2, were anticipated by Bell's patent and Bell's liquid transmitter, as well as by Edison's, because by their excessive breadth they were made to cover some of the latter's devices.

The defendants argued that the Bell Company sought a monopoly of the telephone for thirty-two years, from the first Bell patent of 1876, when the monopoly of the telephone current ceased on the expiration of the Bell patent of March, 1876, in 1893; the Berliner patent in

suit began with 1891; that the greater or Bell patent of the current included the lesser or Berliner patent of a better way of producing the current.

The complainant contended that it had, as the owner of the Berliner patent of 1891, the right to enforce it; that the 1880 patent of Berliner was for the discovery that a telephone current flowing through a microphone will produce air waves similar in form to the current; and that the 1891 Berliner patent, the one in suit, is for the discovery that air waves acting on a microphone will transform a current flowing through that microphone into a current similar in form to the air waves; and that these were separate and distinct inventions, and that it was wholly immaterial that these inventions were described in each patent, in view of the fact that the applications were pending at the same time, being divisions of one original application.

The Bell Company claimed that the application for the 1880 patent contains enough to make it clear that it was intended to cover that telephone receiver only, and



BERLINER'S PATENT OFFICE MODEL.

not to cover the transmitter, and to give distinct notice that the transmitter was to be covered by a subsequent patent.

The defendants argued that this could not be; that Berliner was not entitled to claim in one patent his receiver discovery, and also his instrument when used as a receiver, and in a later patent his transmitter discovery, and also the same instrument when used as a transmitter. They also claimed that the 1891 Berliner patent was void, for the reason that since the expiration of the 1880 Berliner patent on November 2, 1897, the public has had the full right to use two Berliner instruments together as a telephone system; that is, that the public now has the full right to a qualified use of Berliner's transmitter discovery in defiance of the 1891 patent, and in spite of the fact that that patent grants the right to exclude the public from any use of that transmitter discovery.

They said the whole question is this: Has the public had full right to use the system described in the 1880 patent and claimed in the fourth claim of that patent, since the expiration of that patent in November, 1897? They contended that the public has the right. If the 1891 Berliner patent was valid, it took away that right until November 17, 1908.

The counsel for the complainant were Fish, Richardson & Storrow, G. L. Roberts and W. W. Swan; for the defendants, J. E. Maynadier, E. P. Payson and R. S. Taylor.

The court says:

"I find the Berliner patent invalid, because at the date of the application, June 4, 1877, Berliner had not made the invention covered by the patent issued by the patent to the American Bell Telephone Company on November 17, 1891.

"Berliner's application says of the instruments shown in the drawing of the patent: 'These simple instruments will reproduce any musical sound uttered in the neighborhood of one of them; but for the reproduction of special sound, such as speech, they are not adapted.'

"A clear statement of the reasons is given, the statement is repeated; and it is said, also, of sound waves, 'nothing of the nature of each wave and the shape of their curves is recorded.'

"He stated that he accomplishes this by apparatus operating to make and break the circuit. His model and drawings, as well as the text of his application, show that he intended to transmit speech by the erroneous method of interrupting the contact of electrodes and breaking the current.

"This document stands in this case as evidence on the question of invention exactly as it was written. It is conclusive evidence that Berliner had not invented, and did not intend to apply for a patent for a constant contact speech transmitter.

"The complainant's attempt to show that statements contained in this document were inserted through the mistake of a solicitor's clerk is a failure. I am convinced that this is not true.

"I find, as a matter of fact, that Berliner did not, before June 4, 1877, succeed in transmitting speech, but, on the contrary, was convinced by his experiments that speech could not be transmitted by the apparatus of the patent in suit.

"I find, also, that he did not, at that date, intend to describe or claim the apparatus as a speech transmitter.

"In view of the original application, the complainant's case cannot be established without proof of successful experiments by Berliner. The invention set forth in the patent lay in experiment. In inventions of this class, the true date of the conception is the date at which the experiment succeeds.

"The complainant concedes that Berliner did not make new apparatus. Proofs that the Reis apparatus, or Berliner's apparatus, or the Morse key, is operative in the hands of experts, does not establish invention by Berliner.

"He is not entitled, as an inventor of apparatus, to claim whatever may be found to be within its capacity, because his sole claim to invention is based upon an alleged discovery of a new capacity in old apparatus. If he did discover this nothing new remains that he did discover or invent.

"In the telephone cases, 126 U. S. 545, the Supreme Court said of an experimenter: 'It was not until after Bell's success that he found out how to use the Reis instrument so as to make it transmit speech. Bell taught him what to do to accomplish that purpose.' Also it was said: 'It was left for Bell to discover that the failure of Reis was due not to workmanship, but to the principle' which was adopted as the basis of what had to be done.

"If it was obvious to Berliner, or to persons skilled in the art, upon reading of Bell's patent, that the Reiss apparatus could perform Bell's process, then the case fails as to invention. If what Berliner wrote in his caveat was obvious without experiment, Bell 'taught him what to do to accomplish that purpose.' The complainant avoids the defendant's point that Berliner made no invention in using Reiss' old machine by Bell's old method, by evidence that it was not known that such changes as could be effected between solid electrodes would vary the current sufficiently or in the desired proportion. This required discovery through experiment.

"The complainant's contention that its case can be maintained irrespective of experimental results is therefore untenable. To claim that Berliner made an invention because scientific men would have deemed it impracticable to practice Bell's method with solid electrodes, and be made to vary in the proper proportions, and also in the same case to claim that Berliner, in writing his caveat, must, as an inventor, have perceived that his project was necessarily true and that experimental verification was not necessary, is highly inconsistent."

The court concludes the patent in suit is invalid for these further reasons:

"1. Because the invention described in the patent is radically different from the invention described in the application; 2, because the invention was previously patented by Berliner; 3, because Edison was the prior inventor."

Claims 1 and 2 of the Berliner patent in suit are held to have been anticipated by Bell's patent and Bell's liquid transmitter. Under this latter ground the complainant claimed for Berliner a new "electrical mode of operation," which the court says was, in fact, Bell's, and also a new mode of treating the circuit, i. e., varying without interrupting it, which also was, in fact, Bell's. And these two claims of the Berliner patent, when read according to their natural significance, the court says, undoubtedly include Bell's liquid transmitter, and are invalid for excessive breadth.

The court also holds that these two claims of the Berliner patent are anticipated by Edison, because their excessive breadth includes various devices of Edison which like Bell's liquid transmitter, employ a battery current and a variable contact of electrodes, and variable pressure. These devices of Edison were of February 9 and April 1, 1877.

The court says:

"By claiming 'variable pressure' of electrodes as a method or principle, the complainant has attempted to monopolize a feature common to many constant contact transmitters, and thus to discourage and hamper further invention in the same line of industry. The claims are plain. They cover all forms of variable pressure; also contact pressure transmitters before us in this case. I am of opinion that they are void and cannot be saved by the specifications. * * * The complainant also claims for Berliner invention in the use of the minute force of a sound wave to vary pressure between electrodes, and invention in the discovery that accompanying variations of pressure were corresponding variations of current. This is in the Bell patent as well as in Bell's liquid transmitter, and in various devices of Edison.

"The complainant is certainly not entitled to claim as a novelty the utilization of minute forces, after the Bell patent and Bell liquid transmitter, and in view of the contention that Edison intended to compress a mass of plumbago thereby. Berliner borrowed his apparatus for 'transmitting the impression of agitated air' bodily from Bell's second patent. As variations of current are proportional to variations of pressure at the diaphragm in all transmitters, it is not remarkable that they are also proportional to variations of pressure at the place in the circuit where the change of contact occurs and where the force exerted upon the diaphragm is expended upon the circuit.

"It is the principle of Bell's magneto instrument and of his variable contact transmitter, that the current shall vary proportionately to the pressure at the diaphragm. It is a principle of the variable resistance method that the resistance shall vary by pressure exerted upon the circuit and proportionally thereto.

"In the liquid transmitter is the principle that the current shall vary proportionally to the pressure at the diaphragm, and also proportionally to the pressure between electrodes; and also that as pressure on the diaphragm and between electrodes is weakened, the current becomes less intense; as it is strengthened, more intense. This was also in the Edison before Berliner.

"We are not dealing with claims carelessly drawn by an ignorant inventor, but with the phraseology of experts framed more than two years after public use of the invention, with the intention of asserting that Berliner was the orginator of very broad principles that control the practical art of telephony. Those principles are Bell's."

The court further concludes that claim 1 of the patent for a method is invalid. It says that the patent discloses nothing patentable as an art, method or mode for operation.

The court says that if there was involved a discovery of the value of minute variations of contact in changing a current, this led merely to the construction of apparatus, and not to a new art or method. Beside this claim is held invalid because of two years' public use before the patent.

Assuming that the specification discloses an invention, and that by limitation claim 2 can be saved, the court holds that the patent is neverthless limited to the structure therein described, and so limited that the defendants do not infringe.

The court says that the patent does not disclose or suggest any material other than metal, with metallic electrodes; and it is not proven that metallic electrodes are generally suitable for practical use in a speech transmitter.

The court holds that "the conception of Edison of the use of carbon for speech transmission preceded Berliner's conception of the use of solid, metallic electrodes; that from his first conception Edison diligently proceeded upon a line of experiments that led to an invention of remarkable character, which borrows nothing from Berliner, has no substantial resemblance to what is shown in the Berliner patent, and cannot be identified with it by an ingenious use of language. The defendants owe nothing to Berliner."

COPY OF BERLINER PATENT.

In order to enable the readers of TELEPHONY who are not familiar with the Berliner patent to obtain a clear understanding of it, and to refresh the memories of those who have not recently read it, a full copy of the specifications and drawings is given below:

To all whom it may concern:

Be it known that I, Emile Berliner, of Washington, in the District of Columbia, have invented a new and useful improvement in combined telegraph and telephone of which the following is a specification:

My invention consists in a new and useful improvement in transmitters for electrically transmitting sound of any kind, of which the following is a specification:

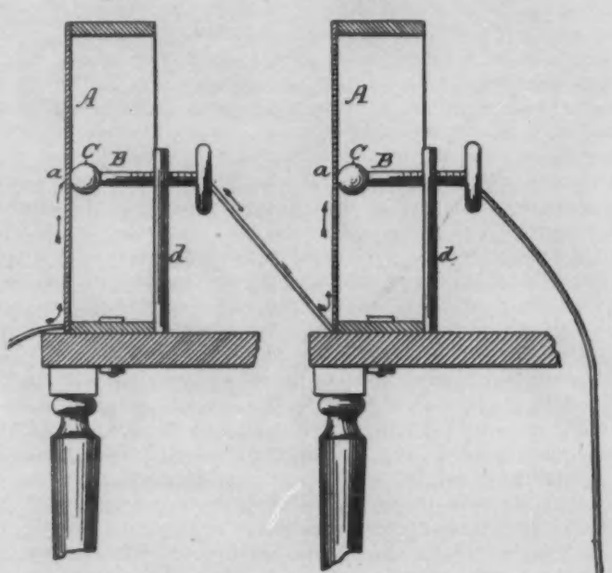
It is a fact that if at a point of contact between two conductors forming part of an electric circuit and carrying an electric current the pressure between both sides of the contact becomes weakened the current passing becomes less intense—as, for instance, if an operator on a Morse instrument does not press down the key

with a certain firmness the sounder at the receiving instrument works much weaker than if the full pressure of the hand had been used. Based on this fact I have constructed a simple apparatus for transmitting sound along a line of an electric current in the following manner:

In Figures 1 and 2 of the drawings, A is a metal plate well fastened to the wooden box or frame, but able to vibrate if sound is uttered against it or in the neighborhood of said plate. Against the plate and touching it is the metal ball C, terminating the screw-threaded rod B, which is supported by the bar or stand *d*. The pressure of the ball C against the plate A can be regulated by turning the rod B. The said ball and plate are included in circuit with an electric battery, so that they form electrodes, the current passing from one of them

E. BERLINER.
COMBINED TELEGRAPH AND TELEPHONE.
No. 463,569. Patented Nov. 17, 1891.

Fig. 1. *Fig. 2.*



Witnesses
E. E. Masson
Philip Lamson

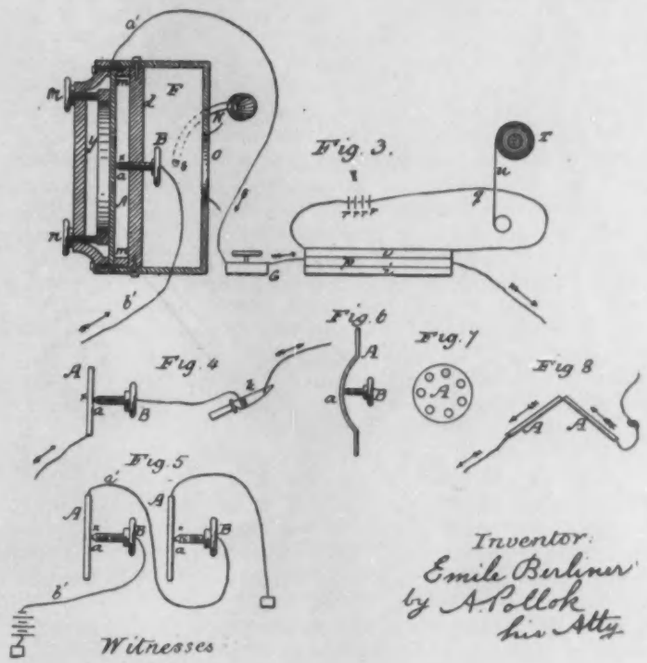
Inventor
Emile Berliner
by A. Pollok
his Atty

to the other. By making the plate vibrate the pressure at the point of contact *a* becomes weaker or stronger as often as vibrations occur, and the strength of the current is thereby varied accordingly, as already described. By placing now, as is shown in the drawings, one such instrument in the station Fig. 1, and another instrument capable of acting as a telephonic receiver in the station Fig. 2, both situated on the same electric current in which a current is passing (as shown by the wire connections following the arrows), sound uttered against the plate of the instrument Fig. 1 will be reproduced by the plate of the instrument Fig. 2, for as the vibrations of the transmitter Fig. 1 caused by the sound will alternately weaken and strengthen the current as many times as vibrations occur, the diaphragm of the receiver will be caused by these electrical variations to vibrate at the same rate and measure. The latter vibrations being communicated to the surrounding air, the same kind of sound as uttered against the transmitter Fig. 1 will be reproduced at the receiver Fig. 2, or in as many other receiving instruments as are situated within the same electric current.

It is not essential that the plate should be of metal. It can be of any material able to vibrate if only at the point of contact suitable arrangement is made so that the current passes through that point. The plate may be of any shape or size, or other suitable vibratory media may be used—a wire, for example. Any other metallic point, surface, wire, etc., may be substituted for the ball. There may be more than one point of contact to be affected by the same vibrations. Both of the electrodes may vibrate, although it is preferable that only one should If the uttered sound is so strong that its vibrations will cause a breaking of the current at the point of contact in the transmitter, then the result at the receiving instrument will be a tone much louder, but not as distinct in regard to articulation.

I have also embodied my invention in and used it in connection with some other forms of apparatus.

E. BERLINER
COMBINED TELEGRAPH AND TELEPHONE.
No. 463,569 Patented Nov. 17, 1891.



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by A. Pollok
his Atty

In the drawings Fig. 4 represents a detached view of the vibratory diaphragm, showing its relative situation to the poles of the galvanic current. Fig. 3 represents a view of a complete apparatus; Fig. 5, a view of the diaphragms arranged to receive and transmit the sound waves; and Figs. 6, 7 and 8 modifications of the vibratory diaphragm.

In the drawings the letter A represents a diaphragm or plate of thin metal, of limited conductive capacity, such as iron, steel, German silver, platinum, secured in the frame *m m* in the box F in any convenient manner.

The letter *y* represents a ring resting against one side of said diaphragm and capable of being made to bear upon the same with more or less force by means of set screws *n*, in order that the tension of the diaphragm may be regulated.

The letter B represents a screw or pin of metal, pointed at one end and mounted in a cross-piece *d* in such position that the point will be in contact with the diaphragm A. The diaphragm A is connected with one pole of a battery by means of a wire *a'*, and the pin or screw B with the other pole by means of a wire *b'*.

The box F of Fig. 3 is provided with a tube K, to which the ear of the operator may be applied, in order to hear the sounds produced by the vibratory diaphragm when the instrument is employed as a receiver, and a tube O, through which he can speak when employing the instrument as a transmitter, so that the operator is not in need of moving the instrument or moving his head while carrying on a conversation.

Instead of employing a single vibratory plate, as shown in Figs. 1, 2, 3, 4 and 5, in each instrument, two such plates may be employed, as illustrated in Fig. 8. said diaphragms being connected to the respective poles and in contact with each other at their edges, as shown in Fig. 8.

The diaphragm of my improved receiver or the diaphragm of any magneto-receiver (such as those described by Alexander Graham Bell in his patent No. 174,465 of March 7, 1876, and in his patent No. 186,787 of January 30, 1877) will receive a particularly strong shock at the setting in and sudden cessation of the current when a ticking sound will be heard from the plate; but a weakening of the current alone can also be observed most distinctly and accurately by making, for example, a connection within the same circuit by a wire and the blade of a knife *k*, Fig. 4. When scraping the wire end over the blade of the knife, this scraping is distinctly audible on the plate. Here the current is never entirely interrupted, yet the minute elevations and cavities on the blade, caused by the structure of the steel, and which again cause minute alterations in the intensity of the current, are sufficient to shake or vibrate the plate with varying intensity, thus rendering again the same peculiar scraping noise. If, now, the plate of one instrument, as in Figs. 1 or 5, is vibrated by sound waves (which happens whenever any kind of sound is uttered or is produced by musical instruments in its neighborhood) every wave or vibration that strikes the plate produces between the two sides of the contact a variation of pressure, which causes a variation of resistance at that point, and therefore a variation in the strength of the passing current, and if the sound is sufficiently strong it will break the circuit at said point of contact, the variations in the current thus produced causing similar vibrations in the plate of the receiving instrument. The essential part of the apparatus is the point of contact, which must offer a resistance to the current.

It is not necessary in the transmitting apparatus that the plate should be of conducting material, for any substance capable of vibration will answer, if only at the point of contact provision is made for the current to pass. It is sometimes convenient to use a vibrating plate in the form of a reflector, as shown in Fig. 6, for concentrating the sound, or the diaphragm may be provided with a number of apertures to disperse the sound, as shown in Fig. 7. These apertures prove advantageous with strong sounds, particularly the hissing sounds, as while the sound waves are rushing toward the diaphragm, those touching the plate are repelled and partially destroy the following waves, just as the sea waves when forced against a cliff will be thrown back, destroying those directly behind. The holes permit most of the waves to pass to the other side of the plate, making the vibration of the plate more perfect and even.

I will here describe a recording apparatus which, however, I do not claim.

In Fig. 3 G is a galvanometer, which is located in circuit with the contact pieces or electrodes A B, and which serves as a convenient means for ascertaining the adjustment of the contact pieces of the transmitter, so that a current shall pass. *i p i* is a Ruhmkorff coil or induction apparatus. When a current passes through the primary coil *p* and suddenly is broken, a spark will rush over between the ends of the secondary coil *i i* at *q*. This spark is accompanied by a peculiar sound due to the electric discharge, and if we bring between the ends of the secondary the connecting points *r r r r* a spark will occur between each of them, provided they are near enough to each other, and the peculiar sound will be heard between each of them. I now arrange a strip of chemically prepared paper or other substance *n* to be drawn by clockwork T between the ends of this secondary wire at *q*. Said strip can be prepared in such a way that each spark will produce a mark upon it. If, therefore, the plate A vibrates by sound, each vibration causing a break of contact will produce a spark at *q*, and the strip being drawn through, a succession of marks will be produced upon the strip according to the number of vibrations caused by the sound; but at the same time the sound which was uttered at the plate A will be heard from the sparks rushing over the points *r r r r* and *q*, because every spark produces one wave in the atmosphere in which it occurs, and a certain number of waves will therefore produce certain tones. Therefore, the same sound which is uttered against the plate A will be heard from the sparks. The scraping of the wire end on the knife blade *k*, as in Fig. 4, in the primary current, will also be heard between the wire ends of the secondary current at *r r r r* and *q*. This permits a number of designs for a receiving apparatus within the secondary current. For instance, initials, ornaments, etc., consisting of a number of metal pins, can be constructed in such a way that whenever a tone is produced against the plate A a spark will rush over said metal pins, and at the same time their sound is produced will render the design visible in illuminated characters.

By making the person of the operator a part of the secondary circuit and discharging the sparks in the body in the neighborhood of the ear the sound will be more particularly apparent.

It will be observed that in Figs. 1 and 2 one of the electrodes presents a convex curvilinear surface like a rounded knob. This possesses some advantages, among which are ease of construction and durability, because it does not wear away the opposing electrode as much as a sharp one would, and when the contact with the vibrating body is made of such form the freedom of the vibration is less interfered with.

I do not claim that I am the first inventor of the art of transmitting vocal and other sounds telegraphically by causing electrical undulations similar in form to the sound waves accompanying said sounds. Neither do I claim that I am the first who caused such electrical undulations by varying the resistance of an electric circuit in which a current was passing.

I do not herein claim the novel form of vibratory plate receiver which I have described, because that is a subject of claim in another application.

I claim—

1. The method of producing in a circuit electrical undulations similar in form to sound waves, by causing the sound waves to vary the pressure between the electrodes in constant contact so as to strengthen and weaken the contact and thereby increase and diminish the resistance of the circuit, substantially as described.

2. An electric speaking telephone transmitter operated by sound waves, and consisting of a plate sensitive to said sound waves, electrodes in constant contact with each other and forming a part of a circuit which includes a battery or other source of electric energy, and adapted to increase and decrease the resistance of the electric circuit by the variation in pressure between them caused by the vibrational movement of said sensitive plate.

3. The combination, with the diaphragm and vibratory electrode, of a rigidly held opposing electrode in constant contact with the vibratory electrode, substantially as described.

4. In a telephonic transmitter, a vibrational plate

made concave for condensing the sound, substantially as set forth.

5. In a telephonic transmitter, a vibrational plate provided with one or more apertures, as and for the purposes set forth.

6. A speaking telephone transmitter comprising a diaphragm or disc sensitive to sound waves, combined with a rigidly held but adjustable electrode in contact with the same, whereby the electric current is transformed into a series of undulations corresponding with the vibrations of said diaphragm.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of the subscribing witnesses.

EMILE BERLINER.

SWEDISH-AMERICAN MULTIPLE SWITCHBOARDS.

A full multiple switchboard, without a lot of complicated auxiliary apparatus, affords telephone companies an opportunity to reduce maintenance to a minimum and thereby increase their earning capacity. The Swedish-American Telephone Company is now prepared to furnish full exchange equipment, either the magneto ring down type or full multiple and central energy switchboards from a 10-line to a 10,000-line exchange.

Concerning its full multiple central energy switchboards, will say that all signals, both line and keyboard signals, on this switchboard are of the luminous type, consisting of a miniature incandescent lamp placed behind a three-eighths-inch opal glass bullseye. They are self-restoring in action. This form of signal is claimed to be the most positive ever devised and cannot fail to attract the atention of the operator. It has also the advantage of being extremely compact and including no movable parts of any sort. This permits the most advantageous arrangement of drops and line jacks, namely, the placing of the answering jack directly underneath its line signal.

The cord circuit signals are of the same luminous type, and each pair of cords is equipped with two, the full supervisory system of signals. One of these signals, of course, works only in connection with the answering plug, and the other works only in connection with the calling plug, thus enabling the operator at any instant to tell at a glance the exact state of the connection at that moment.

The keyboards are equipped with ringing key and operator's cam, or with combination key which performs both operations. In this board the strips of drops and jacks are placed in the lower panels and above them are placed the multiple jacks. The multiple jacks are made in strips of 20 each, each jack being on seven-sixteenths-inch centers. Each jack consists of only sleeve and tip springs.

These switchboards even in their smallest units are true universal boards, that is, any board, no matter how small, can, if desired, be increased to a full multiple switchboard of any capacity simply by adding additional sections and without any change in those installed other than the addition of the multiple jacks and wiring of same.

The operation of this system is as follows: To signal the exchange, the receiver is taken from the hook, on which the line signal is at once lighted; when the operator answers by inserting the answering plug in the jack this light at once goes out. On ascertaining the party required, the operator makes a busy test on the multiple jacks, and not finding the line busy, inserts the plug and rings the subscriber. At once the supervisory lamp of that cord circuit lights and remains lighted until the party called answers. When conversation is finished and both receivers are restored to their hooks both lamps in the cord circuit are lighted. This condition of both lamps lighted being the only positive signal to the operator to disconnect. Should one or both of the parties desire other connections when they have finished their conversation, the slow movement of the switch-hook up and down will flash either one or both of the signals in the cord circuit, which will be a positive signal to the operator to connect herself at once with that circuit to find out what is wanted. Each line is equipped with a small relay and this relay controls all of the signals used in handling connections, whether those of the cord circuit or the line signal. Other than this relay there is no relay or coil of any sort used anywhere in the system and the cord circuit is entirely free from them.

This system is claimed to be even more simple than the old style magneto multiple board system with local transmitter batteries. The busy test on this system is said to be very novel and efficient and is applied by the subscriber himself and not by the operator when the call is answered. The instant the receiver is taken from the hook to signal the exchange the line will test busy. This, therefore, assures the subscriber the exclusive use of his line when he wishes it, there being no period of time when his line is unprotected.

Another important feature claimed is the entire absence of the objectionable "click" in the receiver.

This apparatus is designed throughout from the maintenance point of view, and is said to give the most continuous service with the least attention. Different from other common battery systems, it is claimed to be so simple in its circuits and in its apparatus that it can be operated by anyone familiar with the ordinary magneto local battery system.

The Swedish-American Telephone Company will, on application, answer all inquiries concerning its apparatus, and invite correspondence.

SAVING IN FREIGHT RATES.

Railroad transportation is a matter of vital interest to all telephone companies. There are freight rates of from 5 per cent to 30 per cent on the value of articles most generally used by them. These rates differ materially, according to classification and distance. Yet an important saving in freight rates may be had by those who will thoroughly look into and take advantage of the opportunities offered. There are local and through rates, as well as classification. And occasionally the through tariff of one route is considerably less than others. Wherever such occurs the shipper is entitled to the lowest rate, no matter which railroad he ships via. This is interstate commerce law. The usual practice of a railroad agent is to give the regular tariff of his road between points, when inquiry for a rate is made. There is no law compelling such road to publish a rate lower than a competitor, but the law compels other roads to accept the minimum rate published by a competitor, whether such rate is a combination of local rates or a through rate.

Large concerns in Chicago save as high as $100,000 per annum on overcharges, looked up by special men and claimed by rebates. There is scarcely a regular shipper in the country (whose shipments pass over 200 miles) who cannot obtain proportionate savings by getting at the "best rates" between points. This is particularly true of electrical apparatus and wire. For instance, the regular freight rate on "electrical apparatus" between Chicago and certain Texas and many intermediate points is $1.50 per hundred pounds. Yet there is a published rate of $1.09 between these same points, which rate could be claimed by all shippers over whatever route shipped, thus saving 41 cents per hundred. This affects all "telephone apparatus" shipments. The regular freight rate on "wire" to the same points mentioned is $1.10 per hundred, while a published rate via one route makes a rate of 83 cents, which rate should be claimed.

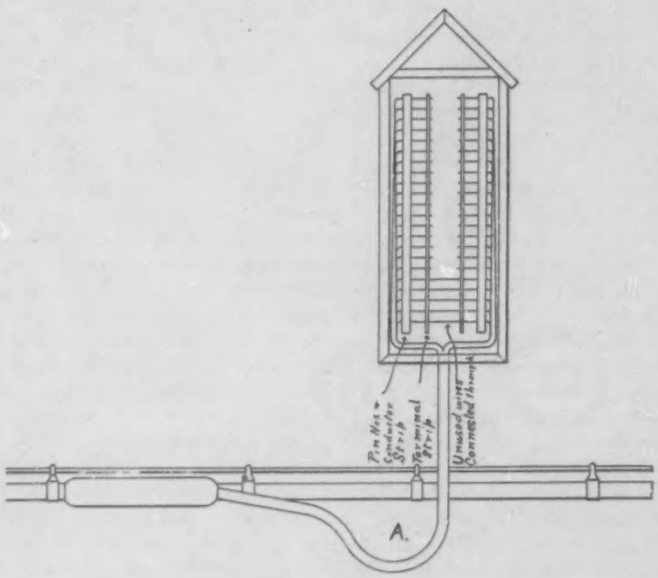
Now, two telephones of the usual type, weigh, boxed, about 100 pounds, as per the ordinary shipping schedules. Therefore, the saving of careful shippers would be about 20 cents per telephone.

MULTIPLE CABLE DISTRIBUTION.

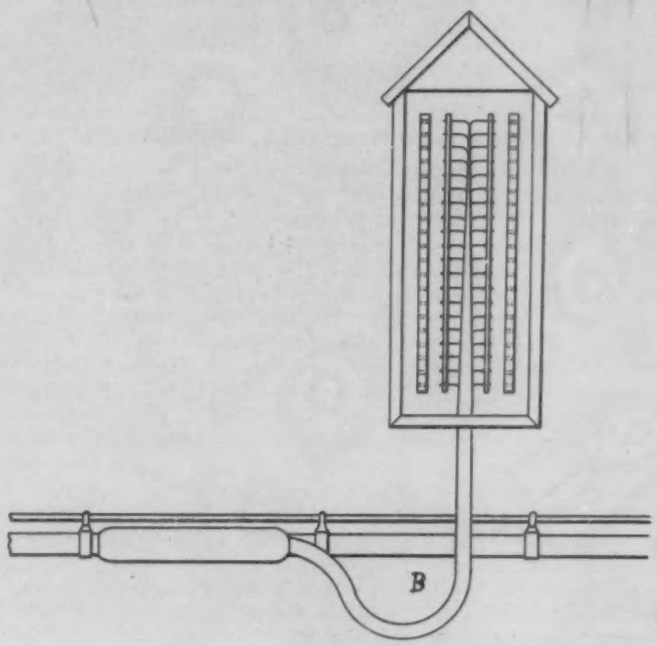
BY C. H. HOFFMAN.

In submitting this article I am endeavoring to deal with the most economical and substantial method of distributing cable pairs from switchboard to subscriber, thinking perhaps it will be of some benefit to the independent companies who have not passed through the experimental age.

An exchange, well cabled, means good service (everything equal), and above all things and for many reasons an exchange manager desires to make his subscribers his friends and not his enemies. Before we can distribute this cable it will have to be erected, and as we started out to do the distributing on an economical but safe and substantial plan, we should also contrive every means to erect the cable under similar rules, for the cabling of an exchange represents considerable expense, at the best. However, I will not at this time talk further regarding erection of cables, but will start with the terminal mount which marks the dividing line between the outside and inside exchange. Supposing the amount to be constructed for 120 pairs, or 240 lines; the cable to be connected to the mount is, of course, a 120-pair cable. About twenty feet from



the mount the paper cable, if such it be, should end, and a piece of wool cable, so called because the wires are insulated with wool to avoid dampness, should be spliced to the paper cable and extended to and be soldered into the line side of the mount. If the city streets are numbered, say, First, Second and Third Street, and the exchange is located at First Street, we will make our first distributing point at Second Street, giving this box the territory between its location and the exchange, as well as the territory between its location and the next distributing point, which we will make at Third Street. Now, as our first cut in the cable is at Second Street, and we have given this point all the territory between First and Third streets, it will be necessary to take out at least pairs No. 1 to 30. We will make a "loop" box of this and will be obliged to cut the cable in two. Do this about three feet back of the pole where cable box is to be located, in order to give room between cut and the pole for the gradual bend of the small cable conveying the wires from the main cable to their respective places in the box. This cut being made, it will now be necessary to secure a piece of 60-pair cable long enough to cover the distance between the top of the box and the place where the main cable is cut, allowing for the splice, etc. Place one end of the 60-pair cable into the box, dividing the conductors into two parts of thirty pairs each. Upon the inside pass thirty pair through the con-



ductor strips at left side of the boz (as in Fig. A) and solder same into their respective contacts on the left terminal strip, from 1 to 30, counting from top to bottom. Take the remaining 30 pair through the conductor strips at right side of box and solder them onto contacts exactly opposite those in left hand strip. This being done, we will test the 60-pair cable, numbering the end to be spliced into the main cable with small tags. Now we are ready to test our main cable from the place where cut to the terminal point, in order to ascertain the correct pairs to be distributed at this first point, which we will term cable box A. A good test set to use in making these tests is an ordinary receiver and battery at each end of the cable, in series. When the same wire is touched at both ends the receiver will give a distinct click. With the main cable being tested at this point, and the first 30 pair in the mount being the ones selected to be distributed, we will connect each wire as it is found onto the number in the 60-pair cable that corresponds to it in the terminal mount, the exchange end of the 30 pair being carried to the left hand side of the box and the opposite end to the right hand side. Take ordinary pot head wire and solder across from left strip to the right all wires not in use at this point, thus closing and carrying these unused wires through, to be used at some other point if necessary.

Having completed cable box A, we will now give our attention to the second distributing point or cable box B (see Fig. B). We will make this a 60-pair leg box and the pairs distributed at this point (Third Street) will be from No. 31 to 90. It will take a 60-pair cable to carry the pairs from the main cable to the box, the same as in cable box A, but we will notice the manner of distributing in this box differs from the method used in box A. The main cable is cut and tested same as

before, but after entering the box the conductors go straight up the center and distribute 30 pairs to the left of center and 30 pairs to right of center, soldering onto the inside of terminal strips. The bridle wires or spiders from the cross-arms solder onto the outside of these strips, and after passing through distribute to the aerial wires. This box will furnish conductors for all subscribers between its location and the next distributing point, which we will make at Fifth Street. This 60-pair leg box also differs from our loop box at A in the manner of splicing into the main cable. A leg box consists of an arrangement simply connecting the wires to be taken out onto the main cable conductors in multiple. Thus it will be seen that all these pairs numbering from No. 31 to No. 90 can be used at another point, if not in use at cable box B.

Cable box C, or the third distributing point, located at Fifth Street, will be a 30-pair leg, and we will take out pairs No. 91 to No. 120. The method of distributing and splicing are the same as employed at box B.

Cable box D, located at Seventh Street, will be the terminal of the cable, and all conductors will be distributed, and any of them can be used either here or at some of the other stations which I have described.

Now our cable conductors are distributed for use some place along the route, but we have not yet bridled the conductors. Each conductor to be used should be bridled to a corresponding pin on the pole, and there connected to the line wire. It will be seldom necessary to bridle out all the pairs that are taken out at any one point, as there should be at least twice the number of pairs taken out when the cable is erected as there are subscribers in the territory given to the box to supply, in order that you may not be cramped in doing future business. Usually bridle out the first pairs in the box as far down the strip as you need to supply your present demand, unless bridled elsewhere (cable properly bridled will have no duplicates). Bridle out five or ten extra pairs for future business. Each box should distribute ahead and not back toward the exchange, except the first box, where it is usually necessary to distribute back to some extent.

Should your conductor at box A become exhausted the best plan is to erect a short piece of cable from the exchange to the first or second pole, end it there and distribute to all subscribers between the exchange and box A, leaving box A to distribute between its location and box B only, thereby releasing a number of conductors that may be used wherever needed most.

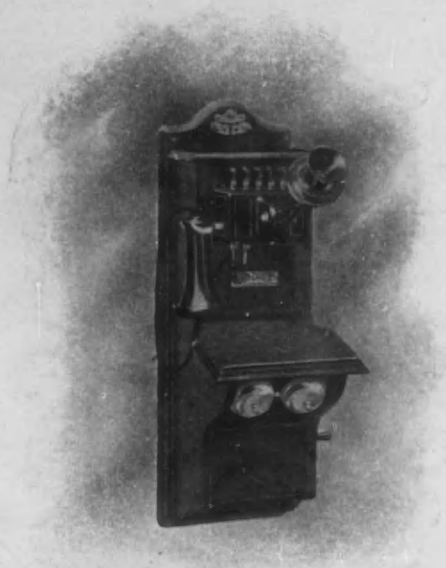
In case you desire to distribute part of the conductors to a street running at right angles, the pin number strips in the cable box are provided with a set of extra holes for use in such cases. Generally erect a 30-pair cable from the first pole either side of the main cable to enter the box, pass through the extra set of holes and solder onto conductor strip at such numbers as may be decided upon. This, of course, would have to be figured out at time distribution was prepared and would be dependent upon the number of subscribers between different points.

This distribution is, of course, only an example. Two cables are seldom distributed exactly alike, owing to conditions to be considered at each locality. It is sometimes a good idea to take out the last five pair at every distributing point for selective signal use and other reasons. Cable records of each box should be kept strictly correct to avoid errors.

The old system of cabling was to run the cable the full length of the pole lead and then perhaps feed back two-thirds of the way, thus covering the same ground twice, which is expensive, much more so now than in the old days. I regret to see some of our large independent exchanges still use this old way of distributing their cable conductors.

NORTH ELECTRIC COMPANY'S NEW APPARATUS.

The North Electric Company, of Cleveland, Ohio, is offering for the spring trade three specialties in the line of telephone apparatus, illustrations of which are herewith given. One of the trio, the "Type E" wall set, is claimed to be the handsomest and smallest complete magneto call telephone manufactured. It is said to differ materially



TYPE E—WALL TELEPHONE SET.

from any other instrument made, with reference to appearance as well as compactness and efficiency. This instrument is complete with batteries, and has all the features offered in the several other styles of wall instruments made by the same company. It is furnished in 80-ohm series, 500-ohm bridging exchange, and 1,000, 1,600, 2,000, 2,500

TELEPHONE DESK SET.

and 3,500-ohm bridging instruments. This company also furnishes the same type of instrument with its new four-bar bridging generator. This it claims to be equal to any five-bar generator manufactured. This instrument is exceedingly simple, being equipped with concealed-cord transmitter arm, mica-insulated, long-lever, self-contained switch-hook, adjustable and locked receiver, pivoted ringer and with the circuits so arranged that the instrument wir-

ing can be instantly changed from series to bridging, or vice versa, at the will of the installer. The company reports large sales for this instrument from managers who believe that it is well to consider not only the efficiency, but the neatness and general appearance of the apparatus furnished to their patrons, especially for use in residences.

BOTTOM VIEW OF DESK SET.

This instrument is claimed by the manufacturers to be the equal of, and in some respects superior to, any of its wall types of apparatus.

The desk set shown is one of two new instruments being put on the market by this company. Among the leading features of this desk set is accessibility to all the working parts without having to dismantle them in any way for the purpose of adjustment or inspection. The mica-insulated hook is on the same principle as that used in the wall sets, and has concealed conductors. This instrument is exceedingly light and well weighted to bring the center of gravity low, so that the instrument is not liable to fall over easily, and has, as will be seen in the bottom view, the induction coil and switching apparatus to go with all terminals concealed in the base.

TWIN TELEPHONE SET.

Another point of advantage in this desk set is the fact that the transmitter can be removed from the standard without the necessity of unsoldering or disconnecting any of the connections. The connections fall automatically into place on screwing the transmitter into its proper support.

The other new type of desk set which is being brought out by this company will differ from the one herewith illustrated and described in that the induction coil will be mounted on the terminal plate entirely independent of the desk set itself. The desk set illustrated is fully nickel-plated and extremely handsome in design and appearance.

The twin set shown herewith is claimed to be more accessible in its parts and of higher grade of workmanship and material than that offered in other telephone equipments. It is an exceedingly handy piece of apparatus for use in connection with the remodeling of old telephones, as well as with central battery telephone systems. The twin set is equipped with a long-lever switch-hook with mica insulation, has an induction coil so placed that it can be removed without in any way interfering with the hook,

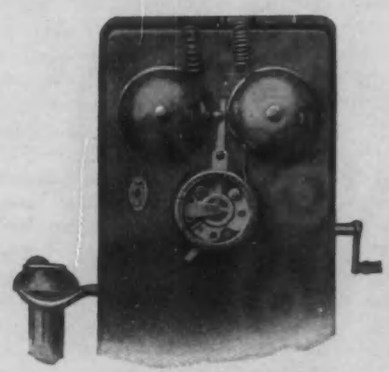
REAR VIEW TWIN TELEPHONE SET.

while all circuits and contacts are easily accessible, either for repairs or inspection. The arm is hollow, the transmitter being connected with the coil by double conductors, no dependence whatever being placed upon the conductivity of the arm or joint. The joints of this twin set are milled so that all parts are interchangeable on a base.

The company will gladly quote prices and send descriptive matter on its apparatus upon request.

A NEW EXTENSION CIRCUIT DEVICE.

A telephone extension signaling device, without magnet coils of any description, that does not insert any extra resistance in the circuit, and that resets itself after every



1001

1002

signal, has been considered an ideal arrangement, but has never before been offered on the market.

The Garton-Daniels Company of Keokuk, Ia., makers of the well-known Garton lightning arresters for railway light and power circuits, have recently brought out the device shown in the cuts herewith, which is known as the G.-D. extension circuit ringer. In cut No. 1001 the device is shown attached to the front of the magneto box. Cut No. 1002 gives a larger view of the device.

It will be noted that a lever, extending upward, is held

against the bell clapper of the magneto. When the bell clapper vibrates the extension circuit is closed, reproducing the signal wherever the bell is located. As soon as the bell clapper of the magneto comes to rest the circuit is again opened automatically.

In the present forms of extension circuit closing devices, a coil is depended upon to release a shutter, which closes the circuit when it falls. It is necessary to reset this shutter at once, or the battery will soon become exhausted. It very often occurs that a call comes when there is no one to answer, and the bell continues ringing until the battery

1003

1004

is run down, a source of annoyance and expense. Then, too, lightning will often throw the shutter at night, when no one is around to reset same, and the battery becomes exhausted.

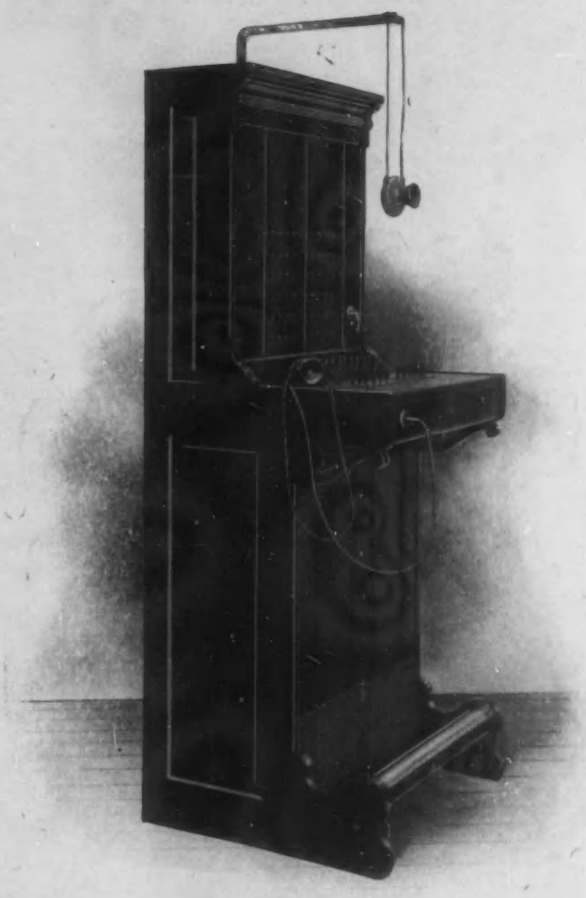
This trouble is obviated altogether by the use of the G.-D. ringer, as it resets itself, after each signal. This device may also be used on party lines, where an ordinary drop would be of no value. The fact that the G.-D. ringer cuts no resistance in the circuit will appeal to practical telephone men, as this is a source of great annoyance with the present forms.

Cut No. 1003 shows an ordinary drop shutter circuit-closing device, now being placed on the market by the same company. This differs from present forms, in that it is not dependent on the action of a magnet, as in all other types now on the market. It is dependent on the motion of the bell clapper of the magneto, the same as the ringer, but differs from the latter in that it must be reset after each signal.

In cut No. 1004, this device, known as the G.-D. extension circuit closer, is shown in position on the front of a magneto. These devices are described in pamphlet No. 26, which is sent on application to Garton-Daniels Company, Keokuk, Ia.

KELLOGG "EXPRESS" SWITCHBOARD.

The Kellogg "Express" Switchboard, which has recently been put on the market by the Kellogg Switchboard and Supply Company, Chicago, is designed with the idea of giving the subscribers of small exchanges a service that will compare favorably with that of the large multiple boards in use in large cities. The experience of this company in equipping many of the largest exchanges in the United States enables them to build a board for small users that embodies many of the strong points of the larger switchboards and at the same time contains several important features which are essential to boards of this size. The materials used throughout in its construction are the best obtainable and the workmanship is of the highest class. All wiring and cable work is of the best silk and cotton insulated wire, made at the company's own factory. The woodwork is oak, but may be any other wood desired. The frame is made with removable front and back panels, which lay the wiring open for inspection or repairs. All wiring is soldered without acid, and is brought down to a connecting rack in the rear, ready for connecting the line wires. The board is equipped with combination mechanically self-restoring drops and jacks, which, it is claimed, are the simplest in construction and the most perfect in design of any yet produced. These drops are of the well known tubular type, mounted on a polished hard rubber strip, reinforced by heavy brass in banks of five in an iron framework, which gives great rigidity and insures perfect alignment of the working parts. But two contacts are needed, one of which serves to restore the shutter to its normal position upon the insertion of the plug into the jack, at the same time cutting the drop entirely out of the talking circuit. The drops are arranged so that any one or any part of one can be removed separately for repairs.



100-NUMBER KELLOGG EXPRESS SWITCHBOARD.

The supervisory system is by means of tubular clearing-out drops. The boards have a capacity of one hundred and fifty lines, but are usually equipped for a capacity of one hundred lines, in which case ten pairs of cords and plugs are provided, with cam combination listening and ringing keys. The magneto generator provided with the board is the usual four-bar type, used with bridging telephones, and is strong enough for any ordinary bridging work. For very long toll lines, very sensitive ringers are frequently installed, which are provided with drop indicators. Notwithstanding the many advantages claimed for this board it is put on the market at the same price as similar boards of other manufacturers. In special cases where a cheaper equipment is desired, the same board is furnished as previously described, with the exception that ordinary manually restored tubular latch drops are provided which do not have the self-restoring feature. This serves to somewhat reduce the cost of the board without in any way cheapening its construction. The Kellogg Company guarantees all these equipments and this fact alone is proof of their reliability and high class.

INDEPENDENT TELEPHONE INDUSTRY FROM THE MANUFACTURERS' STANDPOINT.

BY GEORGE A. BRIGGS.

The necessity which confronts the manufacturer is to produce the best possible apparatus at the lowest possible price. According to his ability or inability to meet the requirements of this necessity depends success or failure. This proposition, with its numerous corollaries, constitutes all there is to the telephone business from the manufacturer's standpoint.

In the early days of Independent telephony these facts were not so well understood. The ultimate scope and possibilities of the business were not dreamed of, and business methods obtained in some quarters which "smelled to high heaven." The life of factories employing such methods was necessarily short, but their influence for evil was unlimited. To them is due any ill feeling which may exist toward manufacturers.

A few capable engineers allied themselves with capitalists in those early days and began the development of the superb apparatus which is procurable for Independent companies to-day. These earnest workers fully appreciated the crudeness of their product and patiently bided their time until equipment worthy of commendation was developed. On the other hand, some manufacturers produced the cheapest instruments that would ring or talk and called to their aid, not engineers and mechanics of known ability and talent, but vendors of words who have been happily characterized as "The Hot Air Brigade." The members of this picturesque order were drawn largely from the ranks of lightning rod and sewing machine agents of a certain class. Immaculate nerve, a choice vocabulary and a conscience of brass constituted their weapons and their armor. Technical knowledge was verbally praised, but mentally despised. Each individual traveler represented the only factory on earth whose product was handsome in appearance, efficient in operation and so constructed as to last forever. The methods employed for impressing this belief on purchasers were varied, according to the demands of individual occasions, but under all circumstances they were works of art. The same amount of brains, versatility and industry devoted to the proper development of the business in a legitimate way would have brought both wealth and fame.

Detached from their motives and the results of their labors, a certain warm sympathy will always be felt for those early missionaries in Independent telephony. They were victims of environment and false reasoning—the evolution of such a mentality was almost inevitable. A young man discovered one day that he was possessed of a certain glibness of tongue which placed him in that respect above his fellows. The exercise of this talent brought immediate results by enabling him to impress his associates with his point of view on almost every subject.

Success along this line, backed by the natural love of adventure which belongs to healthful youth, led to experiments in assuming artificial points of view. When such artificial points of view were religiously accepted by those on whom he practiced, a sense of power became dominant in his mind. The exercise of this power became a necessity, and to that extent the young man became a victim to the power. Thenceforth the development of his judgment was one sided. As he approached maturity, the universal need of earning a living presented itself to him. Following the line of least resistance he adopted for his motto, that "There is a sucker born every minute—and they never die." If this were true instead of being only apparently so, the young man would have found life smooth sailing. But, in spite of his unfailing belief in his maxim and the use of untiring industry, only the most ephemeral success attended his efforts. Turning from one line of endeavor to another, each one brought its first brief period of success to be followed by definite failure. Each time the opportunity and not the method was blamed. Finally, in looking about for some field of activity worthy of his talents, he encountered Independent telephony.

Here was a field that was pure gold. Never did thirsty traveler welcome so heartily the sight of a sparkling spring after a day's march through the desert. Here was a situation where glibness of tongue had ample opportunity to befog judgment, and the field of endeavor was as wide as the continent.

Purchasers of telephone apparatus in those days consisted of two classes:

First. Local business men attracted to telephony by the profitable investment for capital.

Second. Ex-employes of the Bell Telephone Company.

The second class was usually impervious to the machinations of the "Hot Air Brigade" and took counsel with those factories whose motive power was wisdom rather than wind.

The first class, however, was illy prepared to protect itself and fell a ready victim to the plausibility of the salesmen.

The exchange man of the first class referred to was a good business man; usually a good fellow, but seldom possessed of much technical information. Therefore, after listening to the eloquence of the various travelers, he usually became confused and purchased sometimes of the one who made the best personal impression, and sometimes, by a queer process of reasoning, from the one who asked the highest price.

After purchasing and installing a plant under such conditions, trouble naturally followed. "A" apparatus was condemned and "B" given a trial. This process usually continued until a factory was encountered where the term "E. E." was not an unintelligible hieroglyphic. Then our business man would receive some good advice, which so coincided with his own observation that henceforth the "Hot Air Brigade" was given the icy hand.

When our exchange manager had had an expensive encounter of this kind, his experience was thenceforth available for anyone else entering the business. It was, therefore, inevitable that the telephone trade soon became informed as to the true state of affairs, and the hot air factories languished for lack of patronage.

The facts outlined above are well known to the trade generally, and they are recounted at this time for the purpose of calling attention to the radical difference between the policy of to-day and that of five or six years ago. The manufacturer of to-day fully appreciates the promises and difficulties of the future. He knows that the best interests of the exchange and toll line are identical with his own. He realizes that true service is of more value than many words. Consequently, a better understanding between the purchaser and manufacturer is, at this time, causing each to have more confidence in the other, and it may be safely stated that no manufacturer will long prosper, or even survive, if his statements or promises are not truthful in both letter and spirit.

Mr. John Paul Bocock's "Romance of the Telephone" will be concluded in April.

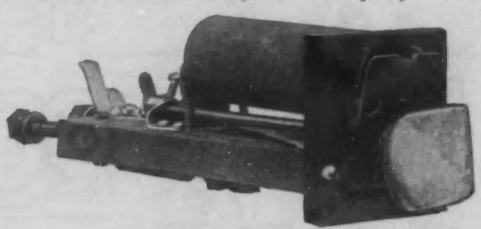
HAINES & NOYES CO.'S NEW APPARATUS.

What is claimed to be a new and extremely simple switchboard, has recently been put on the market by the Haines & Noyes Company, Chicago, Ill., U. S. A. This company has acquired the rights to the automatic self-restoring express switchboard invented by James E. Holyoke of Chicago, and with the improvements added to it by the company's engineers, it is said to be the most rapid, and at the same time, the simplest switchboard in existence.

30-DROP DESK SWITCHBOARD.

While the name of the Haines & Noyes Company is comparatively a new one in the telephone field, yet the personnel is such as to make it in experience one of the oldest telephone manufacturing companies in the business. The active members of this corporation are thoroughly experienced men in the telephone field, and have had considerable experience in the manufacture, construction and maintenance of telephone apparatus. The engineers of this company are experienced men, while its chief engineer has been in the telephone business since 1876, having been during that time with the Bell Telephone Company, the Cushman Telephone Company and the Western Union Telegraph Company. The experience gained while with those companies has been of great use in the perfecting of the Haines & Noyes Company's apparatus.

The instruments made by this company are all of the



DROP AND JACK

"Bell type" and have been thoroughly tested. The switchboard, the rights of which they have recently acquired, is in successful use in this country and in Mexico.

It is of a handsome design, and is furnished in selected, quarter-sawed oak, unless otherwise specified, in any sized capacity. The company claims its switchboard to have the most perfectly designed and simplest self-restoring drop in existence.

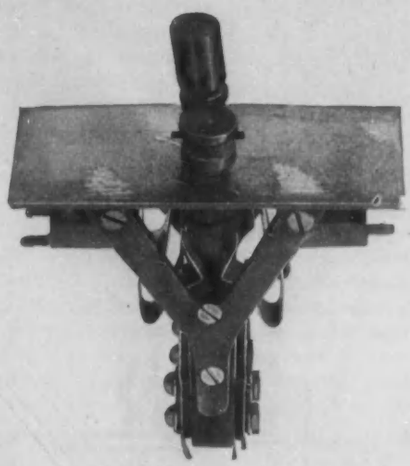
The drop is of the tubular type. The drop magnets have annealed iron cores and armatures, and are wound with a silk-covered wire to a suitable resistance. The face-plate is of hard rubber.

Each drop and jack may be removed entirely independently of the others, by removing the two thumb-nuts on the back.

They are claimed to be free from sticking or freezing, and are constructed with springs of sufficient length and strength to insure the proper making of the electrical contacts. All the springs and contacts in the jacks are thoroughly insulated from each other. The drop is entirely cut out during the conversation, presenting an absolutely free talking circuit. The clearing-out drops are of the tubular type and are bridged across the cord circuit.

The combined ringing and listening keys are of simple design. All the spring contacts are of German silver with scraping surfaces, and are absolutely non-corroding.

The switchboard is wired on the full metallic plan, and therefore is adapted to common return or grounded cir-



COMBINED CAM AND LISTENING KEY.

cuit. The frame of the cam is cast, insuring rigidity and strength. The ring back is placed next to the combined cam and listening key.

The operator on this switchboard has to make but two movements to answer and connect subscribers. The operator's headgear is always furnished complete for long-distance work. The wiring throughout this switchboard is done with the best grade of tinned copper wire, of silk and cotton insulation.

The shutter is automatically restored from the front of the jack, and not from the rear, as in many of the other switchboards. The restoration is done by a simple side pressure of the plug on the shutter as it slips into place.

DROP JACK AND PLUG.

The Haines & Noyes Company construct and equip exchanges from the ground up, and manufacture many styles of telephones for different uses. Its engineers have perfected a telephone system for the right-of-way of railroads, whereby the talking may be done oyer the telegraph wires. They are also perfecting a system which will permit two stations to talk with each other at the same time, automatically shutting off the intervening ones. A specialty of equipping grange and party lines is made by this company.

The use of the telephone in Cairo and Alexandria, Egypt, has grown to such proportions that it has been found necessary to connect the two cities by a telephone trunk line.

READING AN ELECTRICAL DIAGRAM.

BY A. E. DOBBS.

The reading of the many patent office drawings found in nearly all of the electrical papers these days is something of a mystery to many of our friends who have just entered the electrical field, and to whom even a simple circuit is something of a problem.

Taken in connection with the fact that there is comparatively little uniformity in the representation of certain well-known objects, the task to a beginner is not as easy as it looks. About three years ago the Chicago Electrical Association attempted to standardize certain well-known forms, many of which had been in use for years by the Western Electric Company and most other well-known inventors and their craftsmen; and these had been enthusiastically received and closely followed by most electrical draftsmen.

The patent office has also taken a hand in the matter in the endeavor to standardize drawings, and an amateur who undertakes to send in a patent drawing is likely to

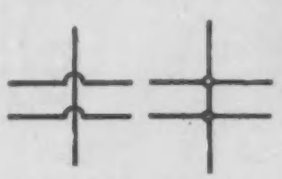


FIG. 1.

FIG. 2

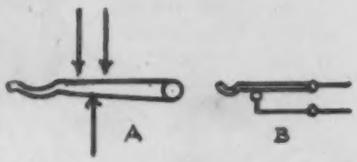


FIG. 3.

have it returned for correction unless familiar with conventional forms.

At first thought it would seem to a novice that it would be a better plan to make a picture of the device it is intended to show, but when we come to think of it some patent drawings cover a great deal of space, and a great many devices in that space, so that pictures of the many devices shown would not be any clearer, take longer to draw and, in some cases, would only be confusing to officials and students alike. Thus the showing of an induction coil by means of two parallel saw-tooth lines occupies little space, makes a clear drawing and, to one accustomed to reading them, shows the entire circuit, or that part of it, at a glance. Originally these saw-tooth lines were spirals and are sometimes represented in this way even now, but

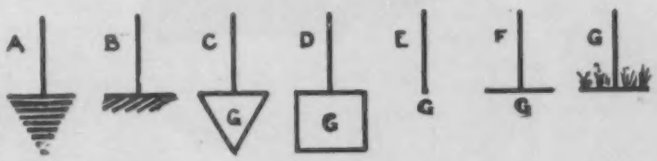


FIG 4

draftsmen found that too difficult to make in a neat manner and the spiral became a plain zigzag line.

The representation of a transmitter by means of a straight line with a ball touching the center was a suggestion taken from Berliner's original patent, and the representation of a battery by means of light and heavy vertical lines is a relic of the old Voltaic pile, while a battery was frequently made by piling alternate sheets of copper and zinc on top of each other with layers of flannel to keep them apart, the whole being saturated with acid, or it may have come from a form of battery once considerably used, consisting of plates hung vertically in a long trough. Nearly all of these symbols are abbreviations, two circles linked together, or a picture of a receiver, taking the place of the entire instrument, unless the telephone has some special wiring, when a sample 'phone is shown wired and the others shown in the conventional manner.

To read a diagram correctly requires a certain familiarity with the circuits and apparatus employed and the use to which it is put; thus, when a diagram shows the conventional forms of a repeating coil the reader is supposed to know the uses and to a great extent the form in which these coils are made, and the same of any other appliance. This makes it somewhat difficult for an amateur to follow

FIG. 5.

FIG. 6.

a circuit of this kind, but then a man must understand his business in any line of work. In the following illustrations the most common forms used in practice are given, and the most common or approved are given first where more than one is given. Thus supposing two or more forms are shown and marked as A, B, C, etc., the forms A and B will be found the most approved or desirable in all cases.

Fig. 1 shows two or more lines crossing each other, but which are not in electrical contact. In making a switchboard diagram, for example, crossing lines cannot be avoided, but they must not be shown as though they were connected.

Fig. 2, however, shows a connection or a branch circuit, the connection being shown by a small dot at the point of contact. Both these figures are largely self-explanatory.

Next we have a representation of changeable switch

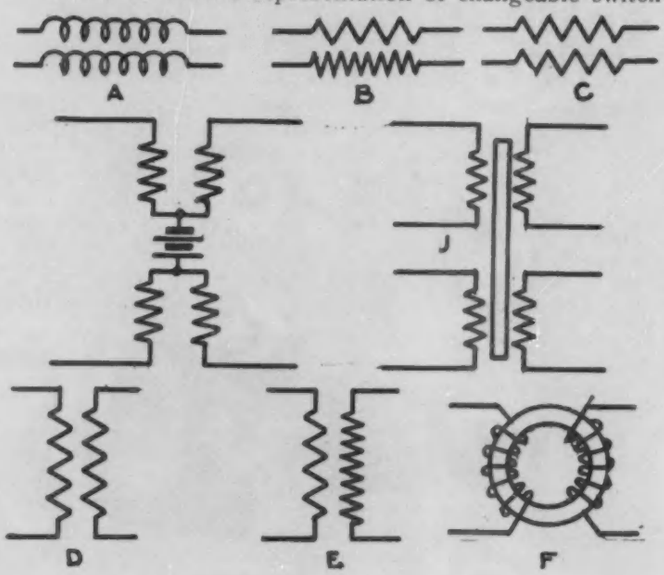


FIG. 7.

contacts, and to make the subject clearer a telephone switch is shown in conection with them. Though represented as arrow points, these contacts may be of the rubbing, sliding, or "biting" variety. These arrow points also may represent a relay contact, key, or even a push button, the original idea probably being taken from a telegraph key. B in this figure shows another form sometimes used, in which a jack contact is shown as a round knob instead of an arrow point, but the first is the association standard and should be used.

Fig. 4 shows the many methods of representing a

ground or earth contact, of which only A and B are now in common use. C and D are frequently found in European drawings; E and F are fortunately rarely seen, while G is the fancy of some draftsman with æsthetic tastes, who had time enough to try to draw a landscape.

In Fig. 5 we have the conventional form of a battery, in which it will be observed there are two vertical lines, one heavy and the other light. In this case the short, heavy line represents the zinc, and the lighter one the copper or carbon element. As the current is conceived as flowing from the zinc to the carbon or copper element, that is therefore the + or positive side of the circuit, and the zinc as the — or negative side, the current flowing from the zinc to the carbon, thence to the line and back to the zinc again. One short and one long line represents a single cell, and in the figure B therefore shows five cells.

In addition to the + and — signs for the representation of direct currents, we also have a sign representing an alternating current; +, which is often called the neutral sign, in a three-wire system of electric lighting would stand for the middle or neutral wire. In telephone circuits it is used to indicate that in some party line systems one bell might be rung by a + current, another by means of a — current, while another might be signaled by means of an alternating + current.

Fig. 6 shows a form sometimes used to designate a storage cell, but is not given as a general rule, they being

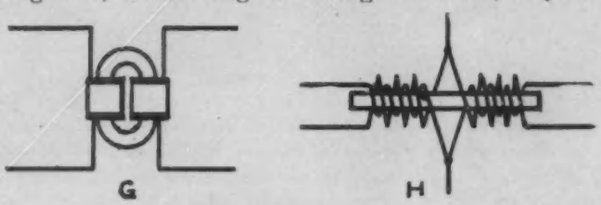


FIG. 7.

shown in Fig. 5. Still it sometimes is the case that two kinds of battery are given, and it is necessary to make a distinction between them.

Fig. 7. In the representation of an induction coil the original form is shown in the figure marked A, but this is now generally made in the form given as B. The primary winding being of comparatively low resistance and few turns, is represented by a heavier line and few points, while the secondary winding, consisting of lighter wire and a greater number of turns, is a finer line with a greater number of points.

C shows two equal windings, which is sometimes done in special forms, though it is generally classed as a repeating coil instead of an induction coil, although they are both practically the same thing, the difference being that an induction coil steps the current from a lower to a higher voltage, or vice versa. Where the teeth are spread wide apart and the lines heavy it generally indicates a coil of low resistance, and the reverse when the opposite is the case.

D shows the common representation of the coils used in toll line work (a picture of it being given at G), while E shows a coil of this kind with a step up and down winding, which is sometimes used on lines of this kind.

Another representation of a repeating coil is given at F, which is a sketch of Farady's experiment, by which he found out that an impulse in one winding produced an impulse in the other when the two windings were on the same iron ring. A more common form of this repeating coil is found at G, in which the windings are on separate spools, but connected magnetically by means of a bundle of soft iron wires passing through the center of both spools, making a magnetic ring. These coils are now generally wound with two wires in hand, over a single core, which is made long enough for the ends to bend back and meet on the outside, or an iron tube is slipped over the outside, and in central battery repeating coils the two windings are split in the middle to allow of battery connections at the center of the coil, which makes two repeating coils on one core, a theoretical diagram of which is given at H.

This brings us to the conventional form of this coil, shown at I, which will now be easily understood.

A special form of battery repeating coil symbol, but little used, is shown at J.

INDIANA MUTUAL TELEPHONE ASSOCIATION.

A special session of the Indiana Mutual Telephone Association was held Wednesday, February 27, at the Grand Hotel, in Indianapolis.

The following persons were present: I. Straus, Noble County Telephone Company, Albion; J. J. Netterville, Anderson Telephone Company, Anderson; Hugh Dougherty, United Telephone Company, Bluffton; F. Koontz, Bremen Telephone Company, Bremen; J. L. Horney, Home Telephone Company, Clinton; J. A. Ruch, Home Telephone Company, Columbia City; A. F. Ramsey, Home Telephone Company, Crawfordsville; L. A. Frazee, Connersville Telephone Company, Connersville; W. B. Coffing, Fountain Telephone Company, Covington; O. T. Spencer, Danville Mutual Telephone Company, Danville; J. A. Thompson, Citizens' Telephone Company, Edinburg; E. Van Syckle, Indiana Electric Company, Dana; John Murphy, Central Energy Company, Frankfort; S. Morrison, representing plants at McCordsville, Ingalls, Greenfield and Pendleton, Fortville; W. A. Wright, Hillsboro Telephone Company, Hillsboro; G. A. Kienle, Indiana Southern Telephone Company, Huntingburg; A. H. Nordyke, New Telephone Company, Indianapolis; S. P. Sheerin, New Long-distance Telephone Company, Indianapolis; A. H. Nordyke, Citizens' Telephone Company, Kokomo; O. P. Friberg, Lafayette Telephone Company, Lafayette; C. M. Zion, Lebanon Telephone Company, Lebanon; J. E. McDonald, Commercial Telephone Company, Ligonier; John W. Pyle, Marietta; S. P. Sheerin, Martinsville Telephone Company, Martinsville; G. S. Van Deusen, Merchants' Mutual Telephone Company, Michigan City; C. D. Knofel, New Albany; A. H. Nordyke, Home Telephone Company, Noblesville; O. Rex, North Manchester; Claude R. Stoots, Nappanee Telephone Company, Nappanee; C. A. Reeve, Plymouth Telephone Company. Plymouth; Jos. Kline, Roachdale; Wm. M. Haynes, Park County Telephone Company, Rockville; D. B. Wilson, Shelbyville Mutual Telephone Company, Shelbyville; L. D. Cox, Central Indiana Telephone Company, Sheridan; J. L. Osborn, Veedersburg Telephone Company, Veedersburg; R. F. Blount, Home Telephone Company, Wabash; I. Straus, Commercial Telephone Company, Warsaw; W. R. Lowe, Winamac; A. B. Diggs, Winchester Telephone Company and Eastern Indiana Toll Line Company, Winchester; M. J. Wagle and W. B. McDonale, New Augusta (Ind.) Telephone Company, New Augusta; A. B. Carleton, Mugg Telephone Company, Quincy; R. L. McOuat, electrical supplies, Indianapolis; Varney Electrical Supply Company, electrical supplies, Indianapolis; Eureka Electric Company, Chicago, represented by I. J. Kusel; Electric Appliance Company, Chicago; Kellogg Switchboard & Supply Company, represented by A. J. Rousseau; Swedish-American Telephone Company, Chicago; Wm. H. Chambers, Chicago, representing TELEPHONY.

The following officers were elected: President, John McGregor of Madison; vice-president, C. M. Zion of Lebanon; secretary and treasurer, H. B. Gates of Indianapolis. The executive committee consists of George W. Beers, L. A. Frazee, A. F. Ramsey and Hugh Dougherty.

The association members were royally entertained by A. H. Nordyke, S. P. Sheerin and H. B. Gates, the officers of the New Telephone Company of Indianapolis. Upon their invitation, the visiting delegates attended the Grand Opera House Wednesday night, and were afterward given a luncheon at the Columbia Club.

A VIEW OF CORPORATIONS FROM THE STANDPOINT OF THE STOCKHOLDER.

BY GRANT NEWELL.

Article Third.

That the reader may comprehend what follows, reference, of necessity, must be had to the preceding article of this series. It will be remembered that it has heretofore been set forth that corporations, being artificial persons, are endowed with such rights and powers only as are specifically or by necessary implication conferred upon them by the sovereignty, under the laws of which they obtain their right to formation and the continuance of their existence. We find, therefore, that bodies corporate have but limited powers, and therein fall far short of enjoying in full the rights, privileges and powers of the natural person. With regard to this matter and the due explanation thereof, we must again take recourse to those provisions of the common law made and laid down during the formative period thereof. In following out this suggestion we go back to the earliest periods in which corporations existed and discover that even then the rights and powers with which they were endowed by the law were strictly confined and limited, both by custom and by the statutory enactments of the times. It is somewhat curious to note what apparently remote causes have exercised a determining influence upon our modern law of corporations. For instance, let us take the conflict between the church and state, which began to rage so furiously in England soon after the conquest, say about the latter end of the twelfth century. Here we find arrayed against one another those two elements introduced into England by William the Conqueror, the party of the church known as the ecclesiastics, and the party of the state known primarily as the military power. The church was that of Rome, the forerunner of that which is now Roman Catholicism, and so brought with it the ideas and doctrines of the civil law of Rome. Up to this time corporations, as such, were probably unknown in England, and it is doubtful indeed if any trace thereof is to be found in the body of the Saxon laws under which that country was governed prior to the conquest. But no sooner was the civil law introduced, as above set forth, than there were introduced with it by these ecclesiastics the principles of corporation law, as found in the civil code of Rome. Banding themselves together, these ecclesiastics took on the corporate form as a convenient means of promulgating their theories and of securing to themselves such holdings of land as rendered them a money power among the people they sought to bring so largely under their control. And such was the foundation of corporate law in England. The opponents of this ecclesiastical party were, however, watching its growth and development with a jealous eye, and when it was observed by them that the church was gaining great wealth and consequent power by becoming the owner of vast tracts of land and holdings in landed property, the party of the state, with whom largely rested the law-making power, devised a means of putting a check on the corporate enterprise of the ecclesiastics, by passing what are known as the statutes of mortmain, the effect of which was to restrict, in fact, to abolish, the power of corporations to acquire and hold real property throughout the kingdom of England. This is important when we pause to consider the fact, for a fact it is, that the import of these ancient statutes of mortmain has been enacted in every state of our Union and that to-day corporations are restricted in their powers with regard to the acquiring and holding of landed property. A perusal of the statutory laws of the various states, as they stand to-day, will reveal that corporations, generally speaking, can acquire title to, hold and enjoy only such real property as is or may be necessary for the proper prosecution of the business enterprises for which they were organized. Hence as a primary proposition it may be laid down as being the law, that artificial persons, i. e., corporations, have only a limited power with regard to the acquirement and holding of landed property. Therefore, as a practical matter, the person who is or expects to become a stockholder in a corporation must needs take into consideration this disability under which the corporation, as a matter of law, necessarily exists. But as if to in part compensate for the disability thus placed upon corporations, the law has generally made provisions whereby certain bodies of this nature have given to them special rights and powers not possessed by the natural person. We find then that in the case of certain corporations which have duties to perform in the line of their business, in the due and proper performance of which the public of right have an interest, power is given by law to take for the use of the corporate enterprise the property of private individuals. This power, however, as above intimated, is given only to what are known as public or quasi-public corporations; so a municipal corporation, such as a city or town, or a private corporation conducted for the use of the public, as a railroad or telephone company, are given power to take lands of individuals for streets or public buildings, for rights of way upon which to operate their trains, or on which to erect and maintain the poles for the carrying of their wires, as the case may be. The power thus permitted to be exercised is generally known in the law as the right of eminent domain, and is so delegated to such corporations by the sovereign power, by which they are created, under the broad claims of public policy. By statute in the various states, this right is regulated and the proceedings necessary to its exercise set forth in detail, and the rights of all parties concerned properly conserved. It follows from what has been said that whether a telephone company may possess the power of eminent domain will depend upon the nature and purposes of its organization. A mere association of persons without corporate form, maintaining an exchange for their own use exclusively, with no intention of accommodating the public in general, or of gaining profit from its operation, would not be entitled to lay claim to or to exercise this power of eminent domain. On the other hand, a regularly organized corporation, operating a line and an exchange for pecuniary profit, and holding itself out for the service of the general public, would be endowed with the right of eminent domain as a necessary incident of its existence.

In connection with this subject it must be stated that the statutory enactments of the various states have a determining influence on many of the questions which arise, and hence the subject can be treated of in these articles only from the standpoint of general rules and principles. Thus a query submitted by a subscriber to this journal regarding the right of a private telephone company to carry its wires on poles across and over the lines of a public corporation of a like nature, can be answered here only in the abstract, and in accordance with the principles already announced. If the public corporation, being first in occupation of the land, is holding by virtue of a prior exercise of its right of eminent domain, or under a franchise or contract with the owner or general occupant of the land, then its rights are vested, and the private corporation becomes a trespasser when it undertakes to erect its lines over and across those of the other company. Being a trespasser, the public corporation would have the right to remove the property of the private concern whenever found upon its premises.

It must be understood as a matter of course that a different rule would prevail in case both corporations were endowed with the power of eminent domain, for in such case the one desiring to make the crossing could obtain the right so to do by the exercise of that power. But in the case as stated, the newer company is powerless and can erect and maintain its crossing only through contractual arrangement with the older. Again, it very often happens that corporations organized for telephone purposes desire to erect their poles along and within a street or a highway, and in such event they require a contract with the municipal corporation having the ownership or control of the street or highway in question; such a contract is generally denominated a franchise, and the peculiarity concerning the matter, from a legal standpoint, is that franchises are always to be taken or construed most favorably to the municipal corporation. In some jurisdictions it is held that when a corporation has succeeded, even wrongfully, in placing its poles, the municipal authorities are powerless to compel their removal, but such a course of proceeding is hardly to be commended and ought not to be resorted to until all lawful means have been exhausted. Our next article will consist in chief of extracts from and citations to some of the leading cases and decisions upon the law as applied specially to telephone corporations.

TRADE NOTES.

MATHIAS KLEIN & SON, the well-known manufacturers of Klein's superior linemen's construction tools, have just issued a new publication called the "Red Book," which they will send free to anyone making application for the same.

HOLYOKE & HOLYOKE, 224-226 South Clinton street, Chicago, report a largely increased business, and are working day and night to supply the demand for their telephone apparatus.

THE ACME ELEVATOR COMPANY of Chicago reports a large business. It manufactures a full line of series and bridging magneto bells, hand and desk generators, etc. New catalogue with full description will be sent upon application.

THE NATIONAL AUTOMATIC TELEPHONE COMPANY has just sold the Carnegie Steel Company a large order of apparatus, and states that the company is receiving many inquiries and orders.

THE DEARBORN ELECTRIC COMPANY states that its business has been very satisfactory, and it is receiving large orders for all kinds of electrical supplies and telephones. The company is soon to occupy large space in the new electrical building on West Jackson boulevard.

THE ERICSSON TELEPHONE COMPANY of 296 Broadway, New York, has issued part four of its series of booklets, describing Ericsson apparatus. We are informed part five is also off the press and will be sent free to anyone interested. The booklets are gotten up in an attractive manner and contain some valuable information.

THE GARTON-DANIELS COMPANY of Keokuk, Ia., reports that the G.-D. extension circuit devices have been well entertained by the trade, and states that many orders and inquiries have been received for the same. The company is making a special sample offer—mention of which is made in its advertisement appearing in this issue of TELEPHONY.

THE FARR TELEPHONE & CONSTRUCTION SUPPLY COMPANY reports a large gain in sales during the past few months, and states that the prospects for a large spring trade are excellent. It will have ample facilities for taking care of this increased business, as in the near future this company will occupy commodious quarters in the new electrical building on West Jackson boulevard, which are being especially fitted up for its use and equipped with latest machinery. This company is a very progressive one and claims to manufacture strictly up-to-date apparatus, with the very latest improvements. The company carries in stock a complete line of all styles of telephones and telephone parts; also electric and telephone supplies of all kinds.

THE WILLIAMS ELECTRIC COMPANY of Cleveland, Ohio, report large orders for their new style, high power, long distance bridging telephones. They have under way several contracts for equipping some very long and important toll lines with this apparatus, and have large contracts on hand for several complete exchanges to be equipped with their long distance exchange instruments.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY of 32 Cortland Street, New York City, has just completed an addition to its factory which more than doubles the capacity of the same. The company has recently opened a branch office at 186-188 Fifth Avenue, Chicago, under the management of Mr. F. M. Pierce, who for twelve years has been a prominent figure in electrical trade circles.

THE HARVARD ELECTRIC COMPANY, Chicago, has just issued its new catalogue, No. 5, illustrating and describing the company's complete line of telephone protective devices. The Harvard magnet winder is described as an instrument of special utility, which is meeting with considerable favor at the hands of telephone men generally. The demand for the Harvard distributing board is increasing; two different styles are illustrated in the catalogue, which will be sent free on request.

M. B. AUSTIN & CO., Chicago, has just issued a new telephone catalogue, which illustrates and describes a complete line of telephone apparatus and supplies. This company has arranged to handle the telephone apparatus of one of the leading American manufacturers. This arrangement, with the company's complete line of supplies, accessories and specialties, puts it in position to fill orders for complete exchange or toll line equipment on short notice and at moderate prices. The company makes prompt shipments of all orders and would like to correspond with prospective buyers.

THE GLOBE AUTOMATIC TELEPHONE COMPANY is a Chicago corporation, being organized, which claims to have a system so perfect that it will almost maintain itself. The automatic switching apparatus is said to be very simple and constructed largely of steel. Each telephone is equipped with a keyboard with one or more keys, as the case may demand. The factory of the new company is located at 31-45 West Randolph Street, Chicago. Mr. J. E. Morling is president, Mr. P. C. Morling, secretary and treasurer, and Mr. F. A. Lundquist is manager.

THE GILLILAND ELECTRIC COMPANY, Adrian, Mich., has resumed on a large scale the manufacture of telephone and electrical specialties. The company, which was organized in 1887, for many years manufactured pins and brackets for the largest telephone and telegraph companies in the United States.

Mr. James F. Gilliland, the manager of the company, is one of the best telephone men in the business, and has invented and patented a large number of electrical and telephone devices.

The company has installed complete wood and metal working machinery and is prepared to furnish all forms of cabinet work, pins and brackets, and is also equipped to manufacture many specialties at a reasonable price. Its plant, with the capacity for 1,000 men, enables it to fill all orders with promptness, and its favorable situation gives it exceptional advantages with regard to the cost of manufacture. The company states that its product will be of the highest grade and fully guaranteed.

THE STORY OF THE TELEPHONE.

BY HENRY C. STRONG.

A Supreme Court judge gave it as his "opinion" that no man knew how the telephone operated, so that one person could converse, by spoken words, to another hundreds of miles distant. The statement was correct. The telephone, as originally constructed by the first experimenters, many years ago, was an electrical contrivance by which sounds of a vibratory character were heard in the audience-room by all the people assembled. Yet, so faint were the tones or tunes heard that it seemed too insignificant to be considered of practical, commercial utility. The invention, called the "receiver," I have patented. A "transmitter" is another device, and does not send or receive spoken words. It is not used on a closed circuit. My original telephone receiver model was filed in the patent office, May 21, 1877. Subsequent inventors followed the vibratory principle of electrical production and transmission of sounds by the broken circuit of an electrical instrument. The sounds were produced automatically and could not be made audible in any other manner than by the broken circuit, as far as the invention had been used at the earliest date that we have any knowledge of. This fact is well authenticated by all electrical experts and investigators. Not until the war of 1861-65 was there a known inventor who ignored the vibratory theory of sound. Admitting the advancement in telephonic progress prior to 1861-2-3, it remained to be proven by actual experiment in New Orleans, La., by Dr. Everett, that sound was not produced and transmitted over metallic conductors by the vibratory, electrical principles, but by another law of the universe first discovered by Dr. Everett in Edinburgh, Scotland, years prior to any former experimenter. But how do we know that the doctor was correct in his announcements? By actual demonstration over a mile of non-insulated wire submerged in swamps and water, in the presence of citizens of New Orleans, who witnessed the remarkable and wonderful feats of the transmission of audible sounds—spoken or otherwise—just as you please to term it.

It could not be expected that during the war much progress could be made in inventions of any kind, much less in electrical discoveries. Yet, notwithstanding the disordered condition of things, Dr. Everett managed to perfect and patent the original sound transmitter, and subsequently demonstrated to the examiners in the division of electricity in the patent office that sound was simply "silence in motion." The doctor's claims to having discovered a new and wonderful principle in the electrical production of "sounds of any kind" and his ability to demonstrate the fact was ignored and rejected by the examiners in the electrical department of the patent office. After contending with the office for two years, Dr. Everett appealed to President Johnson to have the patent issued by executive "edict," which was done, and the inventor received the patent just as he had written it, based on his original discovery in Scotland, years before the war. A strange record of events occurred after the Everett patent issued, and in 1876 it was found that Doctor Everett was nowhere to be found on the earth. Friends of the doctor claimed that he had been lost at sea on his way to England, and his patents of 1863 and 1868 were in full force and effect, but not put into practical use. An invention was said to have been made by a Mr. Hayes, a former examiner in the electrical division of the patent office, who examined and allowed the patent of Dr. Everett. Mr. Hayes contrived to keep his knowledge of the discovery of Dr. Everett a secret until he could find an electrician who would cooperate with him and take advantage of the invention of Everett, and thus use the original discovery of the "nature of sound," as patented in 1863 and 1868 by Dr. L. H. Everett of New Orleans. Recently a public statement was made that a model of the original device of a speaking telephone had been discovered "on the shelves of the patent office." This is false and fraudulent, as the patent office has no original model of an electrical speaking telephone. The original model has never been filed and still remains in the hands of the original and first inventor.

Let us be honest in our efforts to find the original patentee and honest inventor of that wonder of the century, the "magneto speaking 'phone." Let us cherish the memory of one whose efforts to advance the world in knowledge of the laws governing the electrical universe, and if we cannot build a monument of "rock" to establish his claims as an inventor of a world-wide device, by which we can speak to "heirs apparent to thrones and kingdoms," let the humble inventor, be he whom he may, receive justice and all the honors due him.

Your correspondent believes that the time is not far distant when the laws governing the magnetic world on which we live will be so well understood that we will know and understand fully how we are enabled to converse with our friends at a distance, wires or no wires. This history of wireless telephony is now attracting attention, and yet the Everett models and patents are not now understood, but they will receive attention in the near future.

CONVENTION OF THE INDEPENDENT TELEPHONE ASSOCIATION OF WISCONSIN.

The regular annual meeting of the Independent Telephone Association of Wisconsin was held in the state capitol building at Madison, February 13 and 14, 1901. Thirty-seven companies were represented by 50 delegates. Twelve new companies were accepted to membership. Several papers were read, and general discussion followed on various topics, such as the telephone bills now before the Wisconsin legislature, construction of farmer's lines, underground cable work, etc. Resolutions were adopted against there being any competition between Independent companies, against the repeal of the present telephone taxation law, and against the passage of the bill requiring connection between different telephone companies.

The Standard Telephone & Electric Company entertained the delegates with a sleigh ride across the lake, and a banquet at Oak Park. A lecture was given by Professor Trowbridge on wireless telegraphy.

The summer meeting of the association will be held at La Crosse, and the next annual meeting at Milwaukee.

The following officers were re-elected: President, A. L. Hutchinson of Weyauwega; vice-president, C. H. Schweizer of La Crosse; secretary and treasurer, H. C. Winter of Madison.

A bill introduced in the Michigan legislature seeks to regulate the prices that any telephone company doing business in the state can charge subscribers. A schedule, based on the population, has been arranged as follows: Cities under 5,000, $18 for business telephones and $6 for house telephones; between 5,000 and 10,000, $24 and $7; between 10,000 and 20,000, $24 and $8; between 20,000 and 40,000, $30 and $10; between 40,000 and 75,000, $36 and $12; between 75,000 and 125,000, $45 and $15; in cities of over 125,000, $60 and $20, which reduces the rates now charged in Detroit, the largest city in the state.